TELEPHONE ENGINEER

MANAGEMENT • ENGINEERING • MAINTENANCE

JANUARY
1937

• ● •

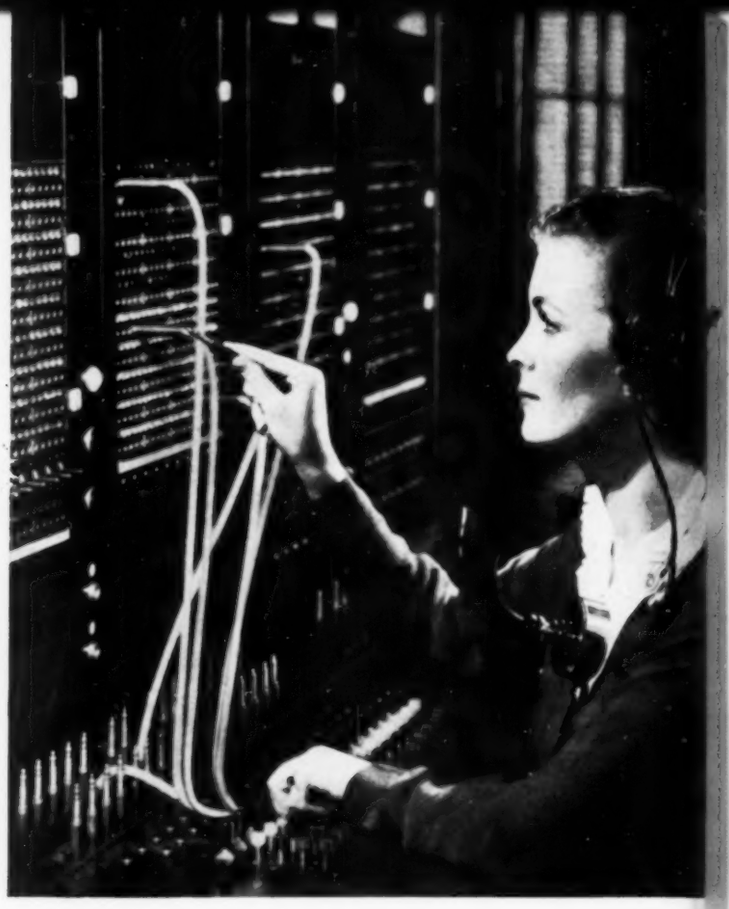
THIS BUYERS' READY REFERENCE SHOULD BE KEPT HANDY AT ALL TIMES

• ● •

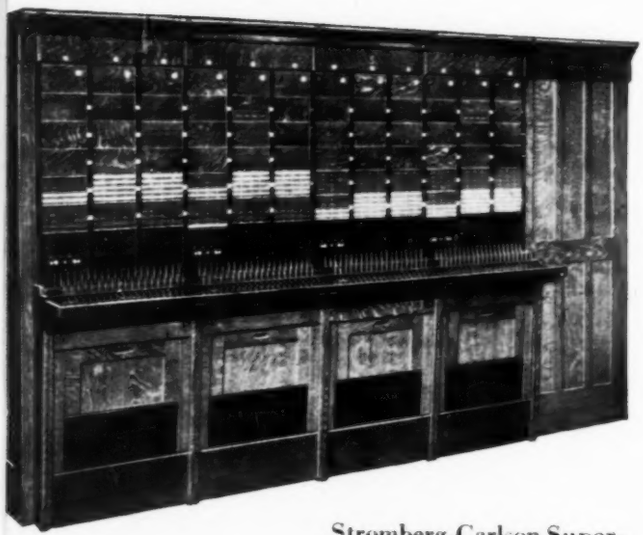
BUYERS' GUIDE and DIRECTORY NUMBER of TELEPHONE EQUIPMENT and SUPPLIES

1937

UNIVERSITY OF WASHINGTON
SEATTLE



ONLY WITH AN OPERATOR-MANAGED SWITCHBOARD IS SUCH EMERGENCY SERVICE POSSIBLE



Stromberg-Carlson Super-Service Switchboard.

. . . promotes remarkable speed and accuracy in operation.

A telephone exchange equipped with a Stromberg-Carlson Super-Service Switchboard received the following letter:

> "I wish to thank the operator who handled the call for the Police Department about 1:30 A.M. last Friday. A burglar broke in the house. I lifted my receiver and said 'Police!' It seemed as if the call had just been put through when the police arrived—all due to the fact the operator handled the call so quickly."

When the central office is equipped with a Stromberg-Carlson Super Service Switchboard . . . an operator-controlled board . . . it is not necessary for the subscriber to turn on a light to provide the illumination to put through a telephone call. The instrument is just as efficient in the dark as in the light. The subscriber need but lift the receiver, tell the operator what emergency exists and the quick-thinking intelligence of the operator does the rest. That is why subscribers like operator service.

The Stromberg-Carlson Super-Service Switchboard is designed for central energy multiple exchanges of any size and is distinguished by 18 Stromberg-Carlson exclusive features.

Before installing new switchboard equipment, investigate the Stromberg-Carlson Super-Service Switchboard.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY
FACTORY AND GENERAL OFFICES: 100 CARLSON ROAD, ROCHESTER, N.Y., U.S.A.
BRANCH OFFICES: CHICAGO, KANSAS CITY, SAN FRANCISCO, TORONTO

Stromberg-Carlson

332539

DO YOU WANT MORE PROFIT FROM YOUR TELEPHONE DIRECTORY?

• • • • then communicate immediately with a company that has been selling TELEPHONE DIRECTORY ADVERTISING exclusively for 27 years.

WE EITHER WILL SELL YOUR ADVERTISING ON A COMMISSION BASIS OR WILL PUBLISH YOUR DIRECTORY COMPLETE.

Our salesmen are trained in understanding how to build up Public Relations for Telephone Companies.

WE GUARANTEE TO MAKE OR SAVE YOU MONEY

L. M. BERRY & CO.

TELEPHONE DIRECTORY ADVERTISING

Main Office, Telephone Bldg., Dayton, Ohio
Telephones LD 16 and ADams 4127

L. M. BERRY & CO. LTD., 200 Telephone Bldg., Winnipeg, Canada

BRANCH OFFICES:

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Ashland, Ky.	Charlottesville, Va.	Bluefield, W. Va.	Jamestown, N. Y.	Mansfield, O.	Freeport, Ill.
Tampa, Fla.	Greenwood, S. C.	York, Pa.	Rochester, N. Y.	Lafayette, Ind.	LaCrosse, Wis.

OUR SALESMEN COVER OVER 2700 Cities and Towns

AMERICAN

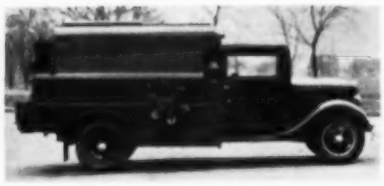
PUBLIC UTILITY BODIES

. . . TYPES For EVERY NEED

Line Construction Types

Built-in Crew Compartment Bodies for Five and Seven Men.

Standard Type Bodies for Trucks Equipped with Manufacturers' Standard Cab.



Combination Light Line Service and Installation

Types LI and LIU Light Installation

Type SL—Section Lineman's Body

Types 3400 and 3425 Cable Splicer Body

Type 3119 Rural Installation Body

Cable Splicer Trailers

Combination Construction and Tree Trimming

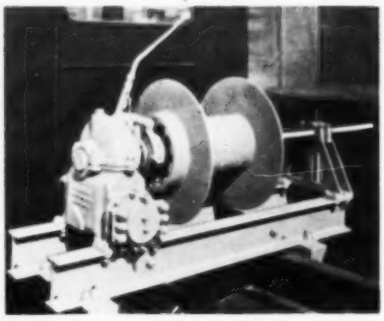
WINCHES

Model A-100 Single Drum — Model B-100 Single Drum

Model A-350 CB Single Drum with Clutch and Brake

Model A-626-B Double Drum — Model A-250 Single Wide Drum

Model A-1626-CB Double Drum with Clutch and Brake



POWER TAKE-OFFS

Split Propeller Shaft Types

Type P Single Drive — Type P-2 LL Dual Drive

Above Types are Designed for 2-Ton Trucks or over

Type 2000 Single Drive for Trucks of 1½ Ton or under

ACCESSORIES

Thermostatic Water Casks

Pole Derricks — Pole Derrick Jacks

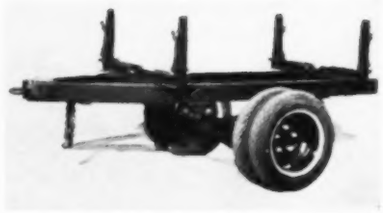
Detachable Nigger-heads

Power Reels — Cable Splicer Trailers

Wire Reels Pay-Out and Take-Up

Winch Line Holders — Quick Hooks

Heavy and Light Duty Pole Trailers



WRITE US FOR OUR COMPLETE CATALOGUE

THE AMERICAN COACH & BODY CO.

9503 WOODLAND AVENUE

CLEVELAND, OHIO

We have combined long experience with modern equipment to provide quality, service and understanding of your problems.

TELEPHONE ENGINEER

A MONTHLY SERVING ENTIRE TELEPHONE INDUSTRY

30-DAY LIFE FOR READERS AND ADVERTISERS

MANAGEMENT • ENGINEERING • MAINTENANCE

Founded in 1909

Published Monthly by Telephone Engineer Publishing Company.
A magazine devoted to the interests of the entire telephone industry —operating men and manufacturers.

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Phone Franklin 4094

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J. A. SMITH, President and Treasurer — L. M. BERRY, Vice-President
RAY W. SMITH, Vice-President and Editor — D. WEINER, Secretary

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THE POLICY OF THE TELEPHONE INDUSTRY

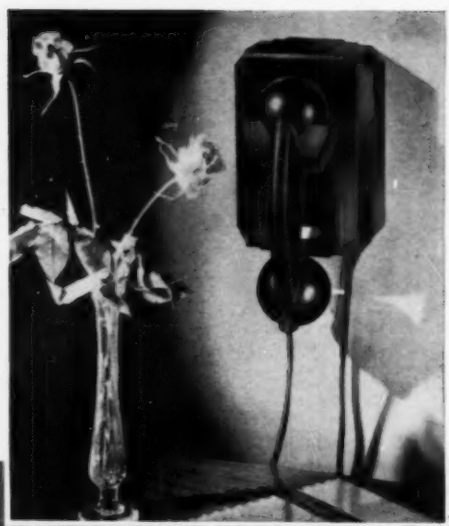
"The most telephone service and the best at the least cost to the public. Telephone service free from imperfections, errors, delays and always at a cost as low as is consistent with financial safety."

• • •

THE TELEPHONE INDUSTRY in 1935—

- **Employed 335,000 persons.**
- **Paid $427,000,000 in salaries and wages.**
- **Paid $104,000,000 in taxes.**
- **Paid $193,000,000 in dividends to 800,000 stockholders.**

Everything FOR T OPERAT



Profitable

T OF TELEPHONE EXCHANGES

KELLOGG *Leadership* SINCE 1897

SINCE 1897 the Kellogg Company has sponsored the cause of independent telephony — supplying its needs and constantly pioneering new developments for the advancement of the industry.

The continual building up of transmission and reception standards; originating the Full-Feature Service switchboard; modernizing P. B. X. equipment; introducing central office flexibility through the development of Masterbuilt switchboards; popularizing the handset telephone by initiating beautiful design and simple, rugged construction; creating the first NON-POSITIONAL transmitter; and developing small, compact Combination Masterphones and new small wall Masterphones with interchangeable parts; are a few of the major contributions toward better service and lower costs which have established Kellogg as the logical source for all your needs.

Because Kellogg fully understands the problems of the operating companies and has the research facilities, engineering experience and necessary manufacturing equipment, it is natural that the industry should look to Kellogg for those practical products which make the telephone business profitable.

MASTERBUILT C. B. SWITCHBOARDS
•
TOLL SWITCHBOARDS
•
MAGNETO SWITCHBOARDS
•
P. B. X. SWITCHBOARDS
•
MASTERPHONES
•
NON-POSITIONAL TRANSMITTERS
•
WALL AND DESK TELEPHONES
•
SPECIAL TELEPHONES
•
RINGING EQUIPMENT
•
POWER EQUIPMENT
•
TESTING EQUIPMENT
•
PROTECTION
•
LINE SUPPLIES

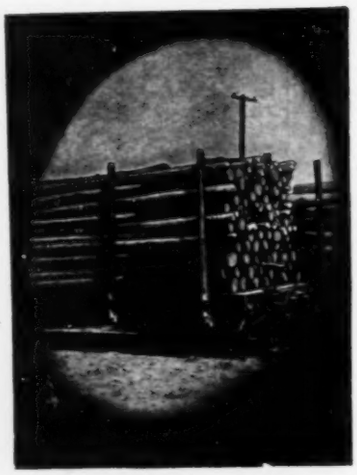
ALSO LEADING DISTRIBUTOR OF LINE CONSTRUCTION MATERIAL

KELLOGG

Switchboard & Supply Co.

1066 WEST ADAMS STREET • • CHICAGO

WE Recommend these B



MacGillis and Gibbs

CEDAR POLES

Northern and Western Cedar Poles from the MacGillis and Gibbs Company have been recognized as the finest for 36 years. Strong, better size and grade, light in weight, clean, non-conductive, and one of the most durable woods, they have every advantage. 24-hour service from two treating plants and yards. Distributed by Kellogg for over 25 years.

Allen

SOLDERING COMPOUNDS

L. B. Allen Co. Inc., have been specialists in making soldering materials since 1893. Their long experience is your assurance of the correct soldering compound to fit every need. Available in powder, paste, oil, fluid or stick in any strength. You get quick results and solid joints with Allen materials. Write for free metal chart today.

Do-More

OPERATORS' CHAIRS

There is but one way to sit in a Do-More chair—the correct way. It has been proven time and again that operators do more work, operate at higher efficiency, yet are less fatigued when equipped with Do-More chairs. Available in padded cane panel, leather upholstered and padded, perforated wood, or leather-covered wood perforated seats.

Ray-O-Vac

TELEPHON T
BATTERIES TRI

have always exceeded For goo
government standards rrect to
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Vac Telephone Batteriesimming

Order YOUR TELEPHONE and LINE SUPPLIES from

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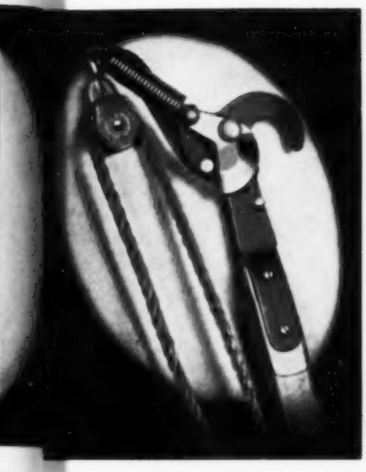


Bartlett
ON TREE
ES TRIMMERS

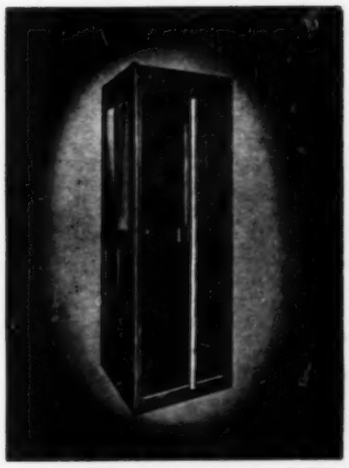
ded For good tree trimming, ard correct tools are needed ons — and Bartlett Tools are l recorrect. The No. 1-W nd ree Trimmer is ideal. ts. Among its features are: is cght weight, forged tool c—eel side cutting blade cemeat holds its edge and is ual guaranteed to cut clean, a sult to 1 cutting ratio, and a sful bsitive spring for return- carg the blade to full cutting lysis ssition. Save time and ex- loser ense, and build "Good Ray ill" with Bartlett Tree teries imming Tools.

Matthews
TELEFAULT

Matthews Woodpecker Telefault is a simple instrument for locating water, "grounds", "shorts", "split pairs", "dead shorts", or almost any other trouble except "opens" in non-magnetic sheathed cable. Tone like a woodpecker on a pole—no confusion with other noises on cable. Extremely sensitive exploring coil assures good results. Self-contained for easy portability. Save time in locating trouble with a Telefault.

Chance
ANCHORS

—meet every anchoring requirement. There is a type in all sizes for every conceivable condition. For instance: WEJ-LOCK EXPANDING, made of malleable iron in 2 way, 3 way, and 4 way types. CHANCE EXPANDING, made of steel in 2 way and 4 way types. NEVER-CREEP, malleable iron anchor. CHANCE SCREW, made in all types. CHANCE CONE, made of semi-steel.



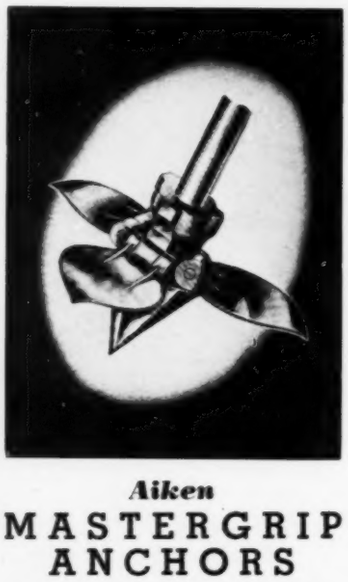
Churchill
BOOTHS

Churchill Telephone Booths are known throughout the entire industry. Soundly constructed, correctly designed and beautifully finished, they make an attractive and profitable unit wherever installed. Ventilation and light are provided for when desired. Churchill Booths are available for single or group installations with all type doors.

SINCE 1897
KELLOGG

ELLOGG
Switchboard and Supply Co. Chicago

WE Recommend these B



Aiken

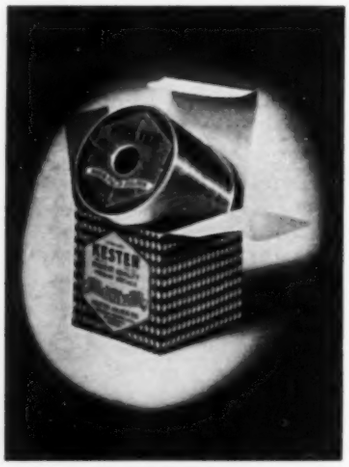
MASTERGRIP ANCHORS

Aiken Mastergrip Anchors are more economical to buy, easier to install, and have greater holding power in all types of soil. They are extremely simple and light in weight. Each blade is larger than the head itself and opens independently into undisturbed soil. Aiken Anchors are made in 2, 3, and 4 way in a size to meet any of your requirements.

American Creosote Works

PINE POLES

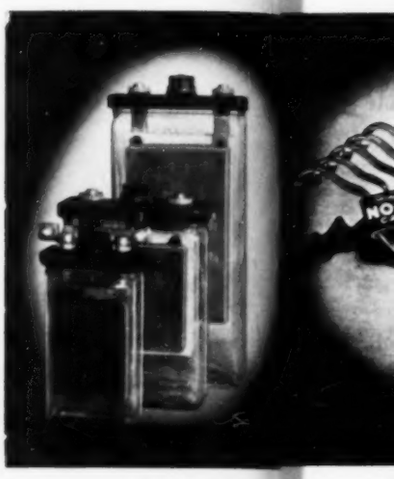
For greater strength and outside plant economy, chose American Creosote Works' southern yellow pine poles. Tests have proven that yellow pine poles are stronger. Pressure treated with creosote, they are thoroughly preserved to assure long life. Standardize on them because they stand up in storms, sleet, and high wind. Fast shipment and quick service assured.



Kester

ROSIN CORE SOLDER

Solder-protected joints are a good investment. To eliminate trouble, every joint should be soldered with Kester Solder. Many improvements have been made in the product, most important being the use of a Plastic form of Rosin Flux. This totally eliminates rosin spoilage caused by air. Improve transmission and be sure of lasting joints by using Kester Solder on all your connections.



Gould

STORAGE BATTERIES

Hold th

Gould offers a line f your small capacity cells h wrist and a balanced three-plate as easy a struction with capaci Chance N ranging from 8 to 40 tings. Ch pere hours. These cel ump off available, from stock alvanizin both the Plante' able rin Dreadnaught types. G ell as ru Batteries can be furni ortion b as individual cells No-Tang bolted connections, o ll these f sembled in treated t our line with burned inter-cell c our con nectors. You get long pecify dependability and stren tings. with Gould Batteries.

Order YOUR TELEPHONE and LINE SUPPLIES from

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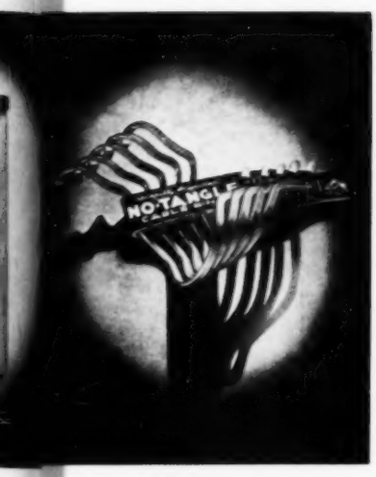

Chance

GCABLE RINGS

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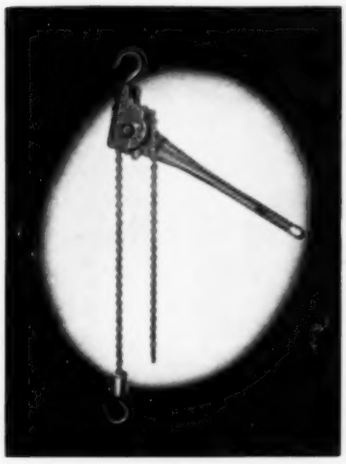


Coffing

RATCHET HOISTS

Meet every pulling requirement. For pulling guy wires, messengers, underground cables, pulling up poles, etc., Coffing ratchet hoists are standard equipment with 86% of the power, light, and telephone companies in the United States. They have demonstrated their reliability and have proved themselves, in rigid comparison with other pullers, to be the lightest, most powerful, safest, and most economical hoists on the market.

Indiana Crapo

GALVANIZED WIRE & STRAND

Men in the field recognize the outstanding advantages of Indiana *Crapo* Galvanized Telephone Wire and Steel Strand. They know from experience that these dependable products can be spliced without injury to the heavy coating of *pure* zinc, that they are easily served, that they last longer in use under all conditions. Fast delivery anywhere, any time.

Seymour-Smith

TREE PRUNERS

Seymour-Smith Tree Pruners cut closer. They are stronger, yet lighter in weight than any other pruner on the market. Easily used on closely tangled growth. These features assure long life and satisfaction: center cutting, one-piece blade with safety catch, re-enforced hook, ball bearing action, malleable iron head, and no spring breakage.

SINCE 1897
KELLOGG

ELLOGG

Switchboard and Supply Co. Chicago

TELEPHONE ADVERTISING LOOKS AHEAD!

Adequate telephone service for tomorrow's home must be planned today. Consistent advertising in architectural publications is designed to show how built-in telephone conduit and convenient outlets will contribute to the comfort and efficiency of modern dwellings. • The advertisement on the opposite page runs during January. It is a typical advertisement, covering every-day problems in helpful detail. Such advertising should stimulate interest and good will for the entire industry.

AN ADVERTISEMENT OF THE BELL TELEPHONE SYSTEM

PROBLEM No. 5

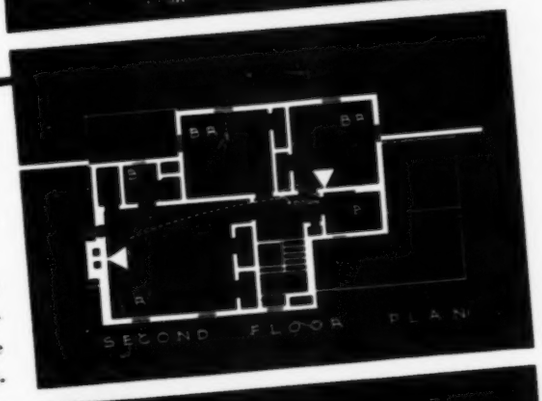
WHEN THE CLARKS...

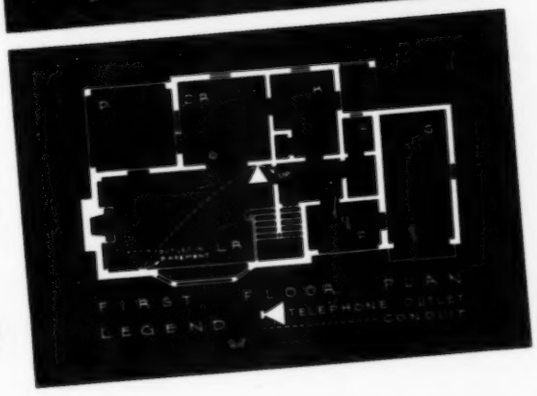
VERY pleasant people, the Clarks. Lyman, Mary and young Lyman, age 9. All fond of the country. It won't be long until they

MOVE INTO THIS HOUSE...

just beyond the city limits. You feel the house is planned right, that it will be comfortable and livable. But have you asked yourself this question:

WHAT TELEPHONE ARRANGEMENTS WILL THEY FIND?...





First of all, built in conduit, or pipe, to prevent exposed wiring and protect against certain types of service interruptions. It's easy to indicate this equipment in your plans. And it's inexpensive to install while the house is under construction.

An outlet for a telephone in the master bedroom will save steps during the day and provide protection at night. An outlet for a portable telephone in the guest room adds an extra touch of hospitality for visitors. Since the living room, dining room and kitchen are all so near each other, one outlet in the living room will be ample for the first floor. And an outlet for a portable telephone in the basement game room will save unnecessary stair climbing when the Clarks are entertaining.

This is a suggested approach to a typical problem. Our engineers will help you develop economical conduit layouts. No charge. Call your local telephone office and ask for "Architects' and Builders' Service."

Tests

THAT SAVE MONEY FOR EVERY BUYER OF TELEPHONE WIRE!

COMPRESSION MACHINE

OXYGEN BOMB TEST

Accomplishes accelerated aging. Wire is subjected to oxygen at a pressure of 300 pounds per square inch and a temperature of 158° F. for 48 hours. Oxygen bomb recognized by A.S.T.M. to determine life of rubber compound.

COMPRESSION TEST

Performed on a machine designed specifically for testing telephone wire, which determines and registers autographically the following characteristics of rubber compound before and after aging in oxygen bomb! (1) Resistance of rubber insulation to compression and to shear or cutting of conductor. (2) Adhesion of conductor to insulation. (3) Centering of conductor in insulation.

WEATHERPROOFING

SATURANT — Thorough impregnation of braid with compound of crude oil asphalt and montan wax.

FINISHER—Continuous smooth layer of stearine pitch, forming a tough adherent coating, highly resistant to weathering and abrasion.

MICA — Ground mica, applied to finisher, further adds to weathering properties.

WHITNEY BLAKE Telephone Wire has for more than thirty-five years been accepted by the Telephone Industry as second to none. We have only been able to maintain this standard by constantly checking and testing materials, improving manufacturing methods resulting in a high quality product.

Telephone Wire, meeting our specifications is good wire and will prove in actual service its true economy.

Our constant research in developing newer and better specifications for the Independent Field, has given us a unique position, and a capacity to meet every need more intelligently and more satisfactorily.

Complete Graybar distributing facilities — 80 warehouses save you time and trouble.

Buy Your Wire by the Year, Not by the Foot.

Specify WHITNEY BLAKE — It Costs No More.

THE WHITNEY BLAKE CO.

SOLE SELLING AGENTS IN U. S. A.

GraybaR

A Purchasing Directory of The Telephone Supply Industry

BASED ON GRAYBAR'S 60,000 Items

Cable Terminals

All types. All with stubs connected and sealed at factory, where facilities are ideal for a perfect electrical and mechanical job. Effectively sealed against moisture.

Telephone Wire and Tape

Rubber covered telephone wire — in standard and specification grades. Iron wire and strand. Friction tape for every purpose to meet the most exacting demands.

Conduit

Fibre. Clay. Iron. Wood. All possible sizes and shapes for all uses. Fibre conduit available in 5 foot and 8 foot lengths, highly economical to handle.

Ringing Machines

Ringing dynamometers. Direct connected ringing sets. Magneto motor generator ringing sets. Ringing machines to operate off A. C. or D. C. Lighting Circuits.

Booths

Folding door type, for single unit or group installation. Receding door type. Swinging door type. Carefully and attractively finished. Resigned after a wide experience of many years.

Linemen's Tools

Everything needed from the top of the pole to the bottom of the hole. Whether it be a pair of pliers and a safety strap or a truck and earth-borer.

Coin Collectors

"Pre-payment" or "post-payment" types. Variety of designs to sucessfully meet all conditions—from simple desk-telephone mounting to centrally-operated device with burglar alarm switch.

Telephone Brackets

A complete line of arms and brackets designed to cover all types of installation. Rigidly built. Require practically no maintenance.

Pole Line Hardware

Everything from the bottom of the hole to the top of the pole. All material for an entire pole line can be covered in one order.

Operators' Chairs

Furnished in oak. Also in birch with mahogany finish. Seats of closely woven cane or of leather over closely woven cane. Exceptionally rugged.

Cross Arms

Of strong, durable, universally useful Rainier fir, available on demand. Also yellow pine. Pins, brackets and insulators of all types.

Batteries

All types. Dry cells. Battery sets. "B" batteries. Wet primary cells. Storage batteries. Chargers. A wide variety, with special adaptions for telephone circuits.

Cable

Tape armored telephone cable. Submarine cable. Switchboard cable. Special cable. Made by largest and oldest cable manufacturer, recognized pioneer in improving cable performance. — Western Electric.

Poles

Seasoned stocks to meet all possible requirements: (1) western red cedar (2) northern white cedar; (3) creosoted yellow pine.

GraybaR

THE GRAYBAR TAG — SYMBOL OF DISTRIBUTION

Offices in 79 principal cities. Executive Offices, Graybar Bldg., Lexington Ave. and 43rd St., New York.

HEMINGRAY Glass INSULATORS

For a long life of dependable low-cost service rely on Hemingray Pin-Type Glass insulators.

No aging or deterioration .... unaffected by sudden temperature changes .... interval strains and stresses removed.... homogeneous in character, only one coefficient of expansion .... sustained high dielectric strength .... clear, flawless for easy inspection .... all surfaces impervious to moisture... tougher, improved glass to withstand rough handling. Write us about your requirements. We'll gladly send samples. Owens-Illinois Glass Company, Muncie, Indiana.

T. F. A.

(Telefon Fabrik Automatic)

Moulded Insulation SWBD. PLUGS

Made right — Priced right

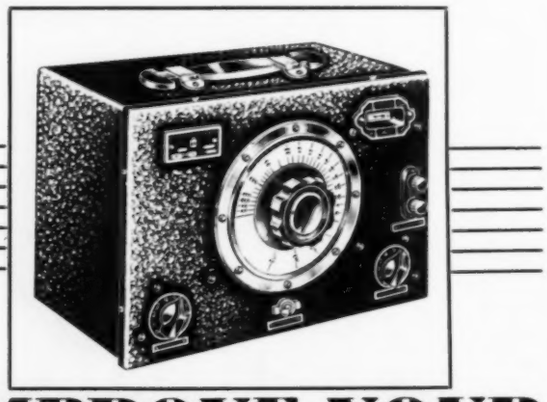
Two Conductor

Three Conductor

Carried in stock

Buckeye Telephone & Supply COMPANY

COLUMBUS, OHIO



IMPROVE YOUR TRANSMISSION!

IF YOUR FACILITIES ARE INADEQUATE
IF YOUR LONG LINES DON'T TALK UP
WE CAN HELP YOU — AT A LOW COST

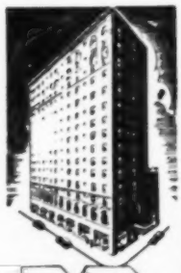
We have manufactured telephone repeaters, amplifiers, loading coils and carrier systems since 1930. This equipment has been installed on more than 7000 miles of telephone lines. Our line of testing equipment is complete and includes voltmeters, ammeters, milliameters, level indicators, wheatstone bridges, impedance bridges, transmission test sets, oscilloscopes and noise meters.

COMMUNICATION EQUIPMENT & ENGINEERING COMPANY

504 N. PARKSIDE AVE. TEL. ESTEBROOK 3110 CHICAGO, ILL.

THE HOTEL OF THE MONTH

Mark Twain HOTEL
ST. LOUIS
MISSOURI



ALBERT **PICK** HOTELS

You'll get more for your money at Pick Hotels. Spacious, comfortable rooms. Delicious food and real personal service. All at moderate prices.

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DAYTON, OHIO	MIAMI HOTEL
COLUMBUS, OHIO	CHITTENDEN HOTEL
COLUMBUS, OHIO	FORT HAYES HOTEL
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CINCINNATI, OHIO	FOUNTAIN SQUARE HOTEL
CANTON, OHIO	BELDEN HOTEL
INDIANAPOLIS, INDIANA	ANTLERS HOTEL
ANDERSON, INDIANA	ANDERSON HOTEL
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OWENSBORO, KENTUCKY	OWENSBORO HOTEL
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ST. LOUIS, MO.	MARK TWAIN HOTEL
WACO, TEXAS	RALEIGH HOTEL

PICK HOTELS

THE WORD **PICK** *SHOULD ALWAYS REMIND YOU OF ALBERT PICK HOTELS*

EVEREADY

DRY CELLS

The Eveready Long Life Telephone Battery . . . the ***super*** telephone dry cell. Longer life—better ***sustained*** voltage characteristics. The battery that is ***really*** economical.

The Columbia Gray Label Telephone Battery . . . not as long-lived as the Eveready Long Life—but lower in initial cost. Excellent ***sustained*** voltage characteristics.

EVEREADY AIR CELL OPERATORS' TRANSMITTER BATTERIES

The improved, low-priced T-600 two-cell Battery

The new T-300 single-cell Battery

An installation consists of one T-600 and one T-300, connected in series. This provides an extremely economical installation, and provides the correct voltage range of 3.75 to 3.3 volts. It provides 6,000 hours of "peak" transmission at a cost of only one cent per nine *talking* hours!

THE NEW EVEREADY INDUSTRIAL FLASHLIGHT...

EVEREADY FLASHLIGHT BATTERIES

The flashlight you practically *can't* break! You can drop it on a concrete floor, without damage to lens or bulb . . . they're protected by a special cushioning. There's no metal on the outside of the case, so it can be handled around "hot" wires without the usual danger of short-circuiting. Saves its cost by eliminating bulb breakage.

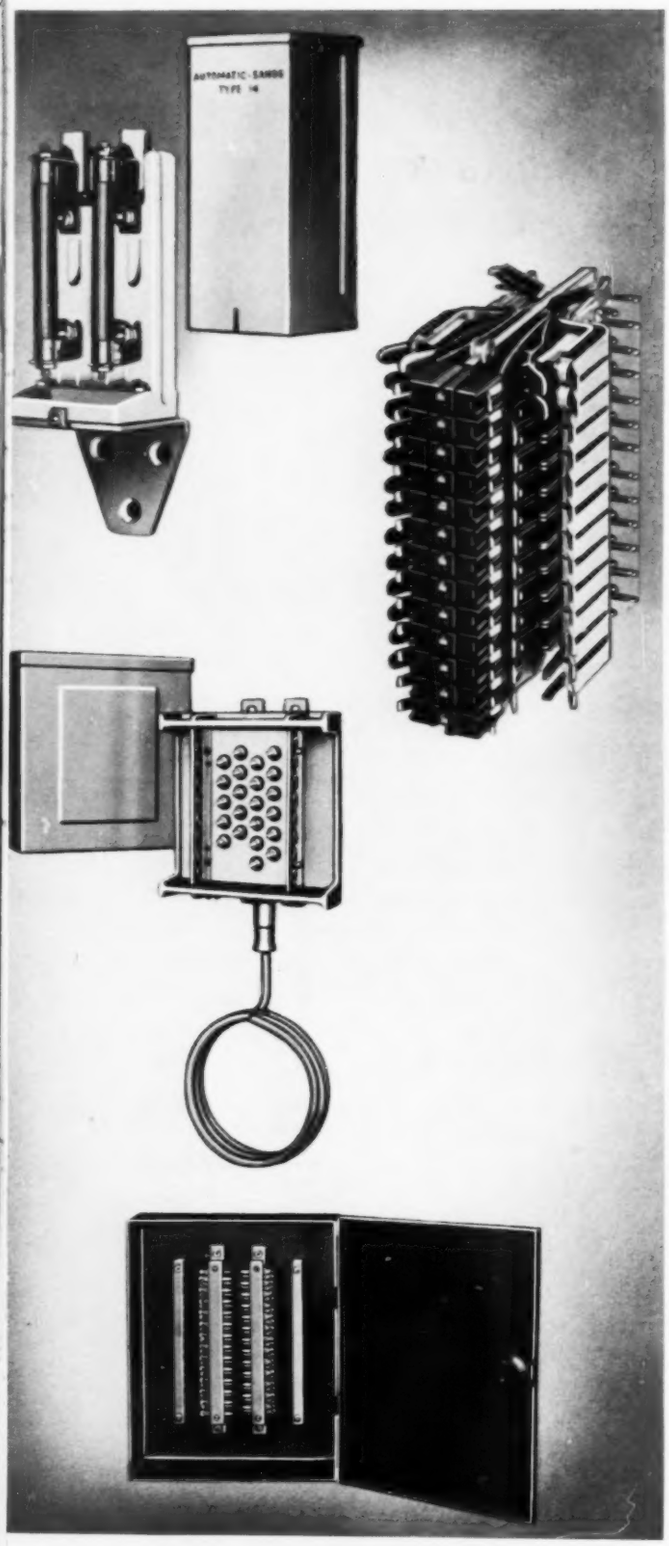
Last longer, are more dependable because they are always FRESH when you buy them. The date line on each battery guarantees it.

NATIONAL CARBON COMPANY, INC.

General Offices: New York, N. Y. • *Branches:* Chicago, San Francisco

Unit of Union Carbide UCC *and Carbon Corporation*

Telephone Protection Equipment



AUTOMATIC-SANDS PRODUCTS

cover every requirement for protection equipment for central office and outside plant.

The Automatic-Sands name is a guarantee of highest quality and exacting standards in every detail of manufacture. Incorporated in this apparatus are a number of important and exclusive advantages in design and construction—products of long experience in developing and manufacturing protective equipment of every type and for every use. Four popular items of the Automatic-Sands line are described briefly below.

THE TYPE 14 SUB-STATION ARRESTER

An enclosed, weatherproof arrester which is very widely usd for sub-station protection. Costing but little more than the indoor type, it has the advantage of being suitable for either indoor or outdoor mounting.

THE TYPE 676 CENTRAL OFFICE PROTECTOR

This heat coil and carbon block central office protector provides complete protection against sneak currents, lightning and direct crosses with supply circuits. The heat coil operates quickly, requires no resoldering and can be used repeatedly.

THE TYPE 60 UNPROTECTED CABLE TERMINAL

A light-weight unprotected cable terminal with reversible hood, enabling the cable to be carried out of either the top or the bottom, as desired. Made of heavily galvanized iron, with thick zinc hood fitted snugly to the box.

THE TYPE 75 BUILDING TERMINAL

Terminal strips are equipped with screw binding posts for distributing wires and soldering terminals for cable wires. Mounted in standard boxes with knockouts provided at top and bottom.

Send for descriptive literature covering the Automatic-Sands line in complete detail.

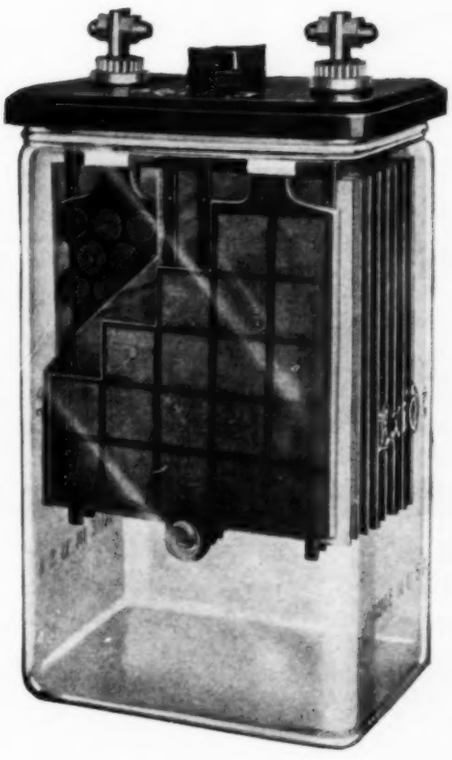
AUTOMATIC — SANDS

TELEPHONE PROTECTION EQUIPMENT

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 W. Van Buren St., Chicago
Export Distributors: AUTOMATIC ELECTRIC SALES COMPANY, LTD., Chicago

Sleet and Winter Winds

. . . may break the electric lines serving your exchange. In such emergencies Exide Batteries will assure the power needed to keep most of your lines in service.



Exide-Chloride Battery cut away to show its sturdy construction. Length of life and reliability far beyond average. This battery is especially adapted for all classes of telephone service.

In a telephone system most of the emergency operating conditions arise from events which cannot be prevented. For example, telephone engineers know that the same wild, winter storms which do so much damage to their own lines may also break the electric power lines serving their exchange. There is no telling when or where this may happen. It may be next year; or, in the next moment.

In the modern telephone exchange such contingencies are anticipated, and provided for, through the use of a common or an emergency reserve storage battery.

For common battery or emergency reserve service, you cannot select a better battery than an Exide-Chloride. Its most important characteristic is absolute dependability. It is designed and built to withstand the most rigorous conditions of telephone operation. It will deliver power when it is needed most — to the full extent of its capacity. This dependable power is important during emergencies since it will help you to keep the majority of your lines in service. In common service the operation of an Exide-Chloride Battery will not be interfered with by either interruptions or fluctuations of the A.C. circuits.

It is emergencies that set the standards not only for telephone service but also telephone equipment. No matter what the telephone job — common battery, emergency reserve, signalling or P.B.X. — Exide-Chloride Telephone Batteries assure absolutely dependable operation, freedom from trouble, an unusually long serviceable life and economical operation.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

6 POINTS OF SUPERIORITY IN THESE NEW LENZ TELEPHONE CORDS

1 NEW CELLULOSE ACETATE INSULATION

With improved moisture-resisting and body-acid resisting qualities. Its improved insulation resistance minimizes possibilities of electrical leakage.

2 MAXIMUM FLEXIBILITY

Cords of three conductors or more are twisted together so as to give maximum flexibility, uniformity and less liable to kink.

3 LONG WEARING OUTER BRAID

The finest wear resisting textile available is used in outer braid, assuring long life.

4 BRONZE ALLOY CONDUCTORS

The Double Wrapped Conductor Ribbon is Bronze Alloy, selected for its greater physical strength and ability to withstand hard usage without breaking.

5 MOISTURE-PROOF IMPREGNATION

The CELLULOSE ACETATE insulation is impregnated with a special non-corrosive moisture-proof compound providing additional protection against electrical leakage.

6 SUPERIOR WORKMANSHIP

Each cord is manufactured in accordance to the highest standards of workmanship, and thoroughly tested.

SEND FOR SAMPLE CORD TODAY!
We will gladly submit sample Lenz Telephone Cord for your personal inspection.

HAVE YOU RECEIVED YOUR FREE LENZ CORD CHART?
For all types of switchboards and instruments. FREE to Telephone engineers and managers!

LENZ ELECTRIC MANUFACTURING CO.
1751 NORTH WESTERN AVENUE • • ESTABLISHED 1904 • • CHICAGO, ILLINOIS

FREE -- 30 DAY TRIAL
with an IRON CLAD GUARANTEE

TELERING

ONLY ONE CONTACT!

PRICE $44.00 EACH
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A RELIABLE & ECONOMICAL RINGING SERVICE

POSITIVELY NO RADIO INTERFERENCE

Reliable ringing service is essential in providing satisfactory telephone service.

Use TELERING and provide the MOST reliable service at the LEAST cost.

Current Consumption Negligible.

Directly converts Commercial Alternating Current to Telephone Ringing Current.

You can always depend upon our full co-operation and prompt service.

Sold by Leading Telephone Distributors

TELKOR, Inc., Elyria, Ohio

Vacuum Grip Pliers

REG U S PAT OFF

58-R

LINEMAN PLIERS

58

LINEMAN PLIERS

BUILT UP TO A STANDARD

NOT DOWN TO A PRICE

Over a Million in Use

87

DIAGONAL CUTTERS

185

DIAGONAL CUTTERS

GOOD PLIERS ARE "GOOD BUSINESS"

WHEN you put Vacuum Grip Pliers into the hands of your linemen and switchboard operators you not only give them labor saving tools of the highest efficiency—but you execute a stroke of "good business."

For the negligible difference in price, as compared with ordinary makes, Vacuum Grip Pliers give you a long-life value that takes the form of a definite and substantial saving.

58-R LINEMAN PLIERS—Built for hard service. Tapered nose; double bevel cutters; insulation strippers. Length 8½"—$3.25. No. 57-R—Length 7"—$2.50. No. 56-R—Length 6"—$2.00.

58 LINEMAN PLIERS—Same as 58-R but with bevel nose. Length 8½"—$3.25. No. 57—Length 7"—$2.50. No. 56—Length 6"—$2.00. With sleeve twister, length 8½"—$4.00.

87 DIAGONAL CUTTERS — Heavy duty. Most powerful diagonals made; an exclusive Vacuum Grip design. Length 7"—$2.50. No. 86—6"—$2.00. No. 85—5"—$1.65.

185 DIAGONAL CUTTERS—Switchboard and electrician's pattern. Matched blades, hand-honed. Popular "vest pocket" size, 5"—$1.75. No. 186—6"—$1.90.

318 BOLT CUTTERS—Length 18".—Cuts bolts, rivets and wire up to ⅜" Six types interchangeable blades. With side-cut blades $5.00. (Also in 14"—24" and 36" sizes).

67 GRIPPING AND CUTTING PLIERS — Heavy duty, light weight. Popular with switchboard electricians. Tapered nose; two adjustments. Length 7"—$2.00. 6"—$1.75; 5"—$1.50.

5 "VEST POCKET" GRIPPERS—For small nuts and other switchboard jobs; a little giant. Parallel jaws; back slanting teeth. Length 5"—85c.

197 LONG NEEDLE NOSE — Heavy duty, with wire cutter. For general use. Length 7"—$2.50. Without cutter, No. 97—7"—$2.00.

196 LONG NEEDLE NOSE — Light weight heavy duty, with wire cutter; very popular pattern. Length 6"—$1.85. Without cutters $1.50. Also in 5" size.

12 SLEEVE CONNECTOR — Splices all size wires; elliptical hole for guy strands. Length 12"—$4.50.

PURCHASING AGENTS: *Write for complete Catalog and details of* 30 DAY TRIAL PLAN *at our risk, for running tests.*

FORGED STEEL PRODUCTS CO., Newport, Pa.

318
BOLT CUTTERS

67
GRIPPING AND CUTTING PLIERS

5
VEST POCKET GRIPPERS

197
LONG NEEDLE NOSE PLIERS

196
LONG NEEDLE NOSE PLIERS

12
SLEEVE CONNECTOR

HOLTZER-CABOT

MAGNETO RINGING SET

- No Brushes
- One Rotating Element Only
- Nothing to Cause Radio Interference
- Close Voltage Regulation
- Designed for Exchanges up to 1500 Subscribers
- Will Run for Months Without Attention
- Minimum Maintenance Cost

WRITE FOR FULL INFORMATION

THE HOLTZER-CABOT ELECTRIC CO.

125 AMORY STREET, BOSTON, MASS.

6161 South State St. Chicago, Illinois | 101 Park Avenue New York City, N.Y. | 112 South 16th Street Philadelphia, Penna.

Perfect Ringing Service For The New Year!

The MASTER Ringing Converter Will Insure It For MANY Years To Come

NOTHING TO WEAR OUT!

- No Moving Parts
- No Vibrators
- No Adjustments
- No Radio Interference
- Reverting Tone Feature

ECONOMICAL

Operates on 110 volts A.C.

PRICE, $45.00

30 DAYS' FREE TRIAL

You Take No Risk

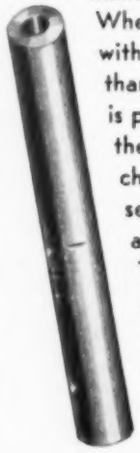
SUB-CYCLE

LORAIN PRODUCTS CORPORATION, Lorain, Ohio.

Lorain Products Corporation is exclusive manufacturer for use and sale in United States. Address foreign inquiries to Automatic Electric Sales Co., Ltd., Chicago, Ill.

Sold By Leading Distributors

NO MORE NOISY LINE JOINTS — NATIONAL NICOPRESS SLEEVES-- Absolutely Air and Moisture Proof-- Assure Quiet Line Joints----

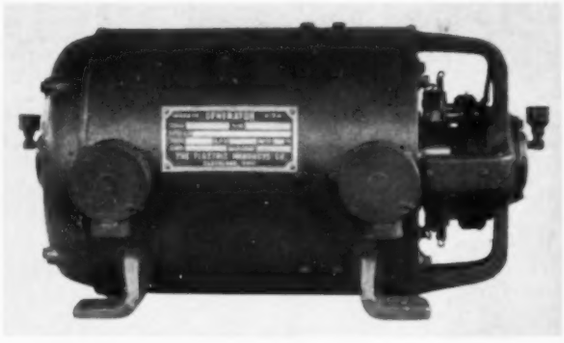


TODAY the demand is for quiet line Joints. NATIONAL meets this demand fully with the NICOPRESS SLEEVE. When once the sleeve, which is lined with a hard Nichrome alloy (harder than metal in sleeves or conductors), is pressed on to the Conductors, with the Nicopress Tool, there is no chance for any air or moisture to seep in and create resistance—and you have quiet Line Joints. These joints are quickly and easily formed either on the pole or on the ground. Use National Nicopress sleeves if you want ideal splices. Write for information and prices today.

THE NATIONAL TELEPHONE SUPPLY COMPANY

5100 SUPERIOR AVE. . . . . CLEVELAND, OHIO

Diverter Pole Generator



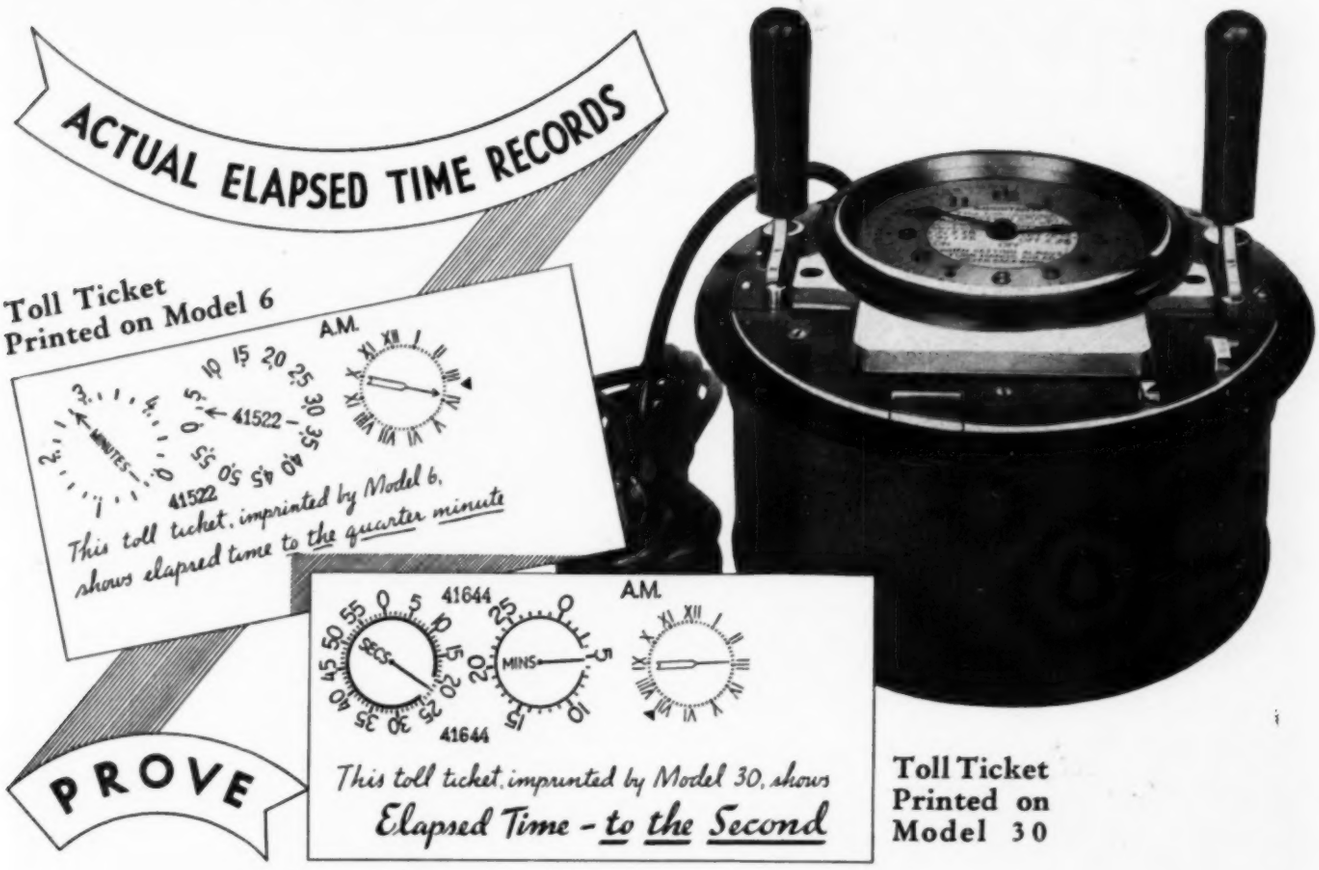
The Standard For Telephone Batteries

For Both Large and Small Exchanges

The Safe and Economical Source of Power

The Electric Products Co.

Cleveland Ohio



that it Pays to ELECTRIFY *your Calculagraph*

Notice these toll tickets, printed by the Model 6 and the Model 30 Calculagraphs. The spring-driven model measures elapsed time to the quarter of a minute—the new electric (Model 30) **prints elapsed time to the second.**

The electric model is equipped with a self-starting synchronous motor for 60 cycle and either 20 or 110 volts regulated alternating current. The mechanism is so designed that it can be fitted to the Model 6 spring-driven Calculagraph. We urge that you install the electric Calculagraph, but if you prefer, your old Calculagraph can be electrified at moderate cost.

Sample imprints sent anywhere in the world on request. Please state the serial numbers of Calculagraphs now in use in your exchange, and estimates for converting them to the Model 30 will be provided, together with complete information about the new features.

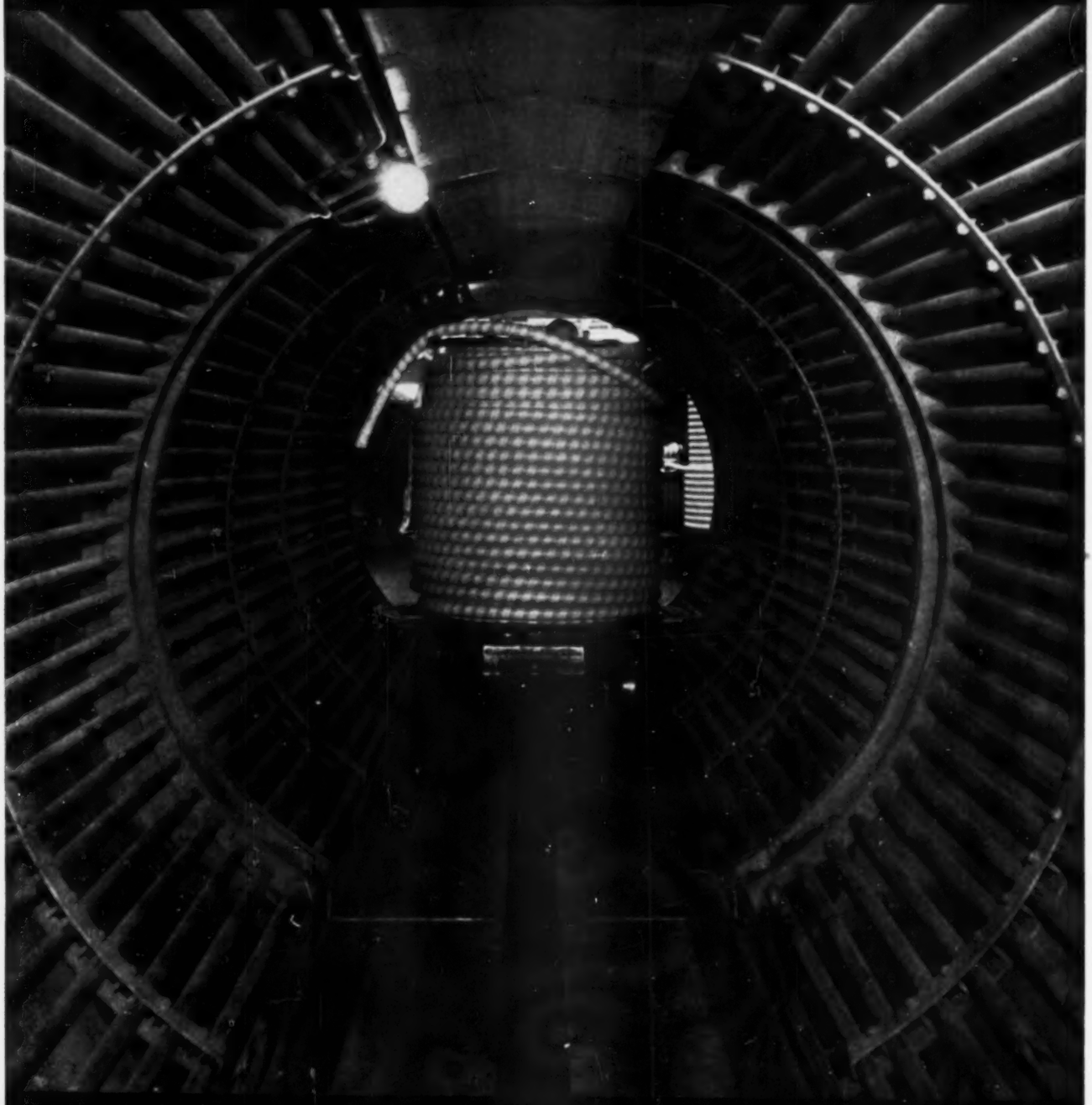
THE CALCULAGRAPH COMPANY

50 Church Street Dept. 22 New York City

CALCULAGRAPH

THE ELAPSED TIME RECORDER

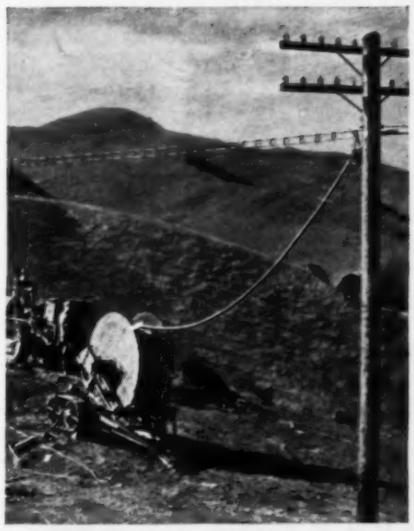
10 times as dry as

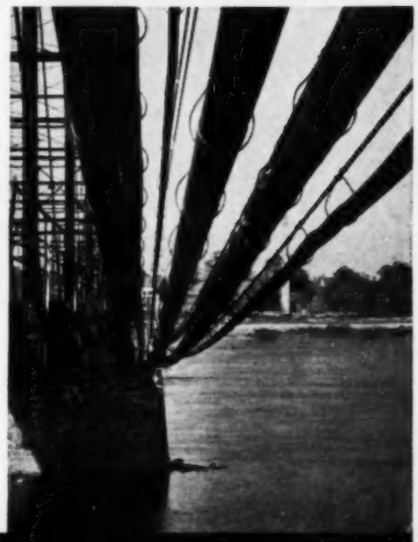


Western

LEAD COVERED CABLE AND

the Sahara!





. . . one of many reasons why Western Electric cable serves faithfully wherever it goes

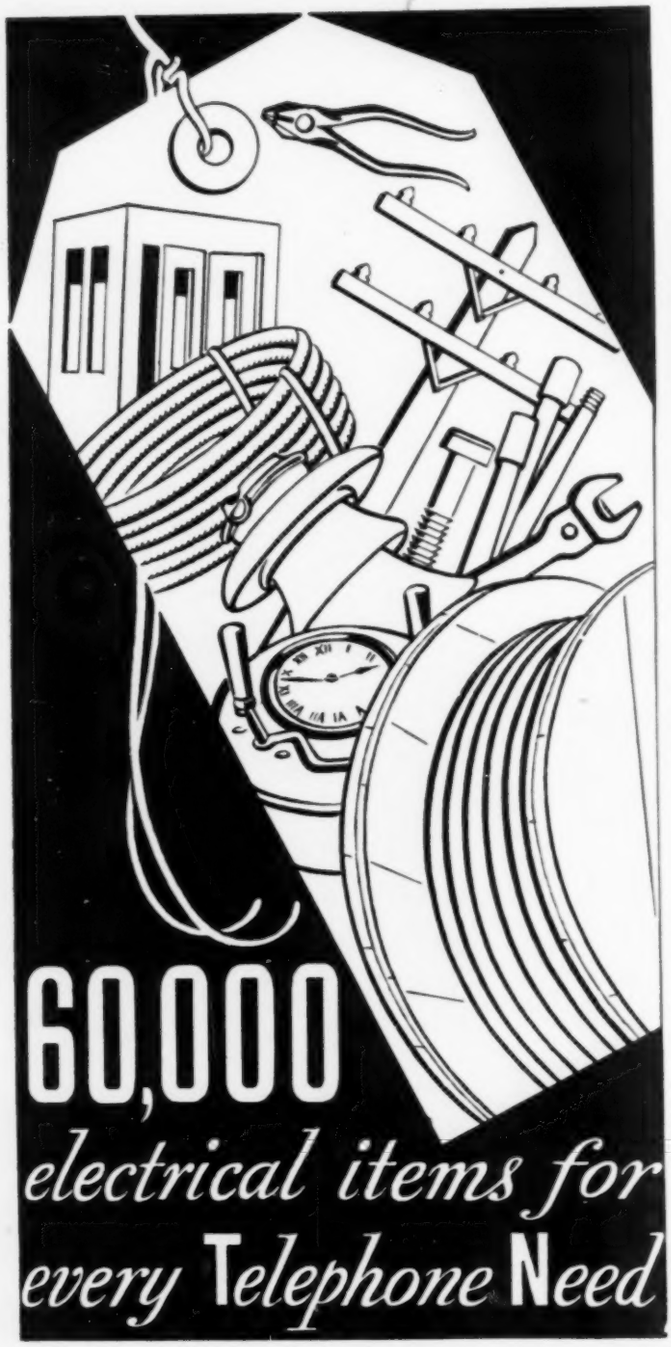
At left you see a cable core going into one of Western Electric's special vacuum drying ovens—where it's twice as hot and ten times as dry as the Sahara desert. You can be sure there'll be *no moisture* left in that cable to give you trouble in service!

Similarly, every step in raw material selection, cable design and manufacture is watched over by Western Electric cable experts. Through years of work for the Bell System, they've learned how to make cable that is *right*—that will help you to give better service to your subscribers year in, year out.

Whatever kind of cable you need, Western Electric has it or will make it for you. Standard types include lead covered, impregnated jute protected, tape armored, wire armored submarine, textile insulated and cellulose acetate lacquered terminating cables. For full information: Graybar Electric Co., Graybar Building, New York—or Graybar's nearest branch.

Electric
TELEPHONE APPARATUS

Distributed by GRAYBAR Electric Co.
In Canada: Northern Electric Co., Ltd.



60,000 *electrical items for every* Telephone Need

In these days when everyone is looking for purchasing economies, Graybar's service of supplies makes economies possible . . . It brings 60,000 electrical items within arm's reach of the telephone user. Does away with "shopping" around. Eliminates expensive stocks ... The natural result of Graybar's long experience in meeting the special needs of the telephone industry—an experience that goes back to the beginnings of that industry in America. **GraybaR**

OFFICES IN 70 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BLDG., N. Y.

The "Button Test" demonstrates the flexibility and the tenacity of the zinc coating which is applied by the modern hot process.

HOT *Galvanized* to assure Longer Life

U·S·S Perfected Telephone, Telegraph Wires and Strand are galvanized by the hot process. By this tried and tested method, the properly treated wire is passed through a molten bath of pure, high grade zinc. Both metals are chemically bonded — and form as strong a combination as when hydrogen is combined with oxygen to form water.

When the wire leaves the bath, it assures an even and uniform coating that fully satisfies every service and laboratory requirement for ductility, strength and corrosion resistance. The coating will not flake, crack or disintegrate under the hardest of service conditions.

Because of these facts millions of miles of USS Perfected Telephone, Telegraph Wires and Strand have been placed in service —and coil after coil is specified today with every confidence of longer life and a full measure of value.

USS Perfected Steel Strand is so constructed that it can be cut at any point without seizing. In construction work this fact saves much time.

U·S·S PERFECTED

Telephone, Telegraph Wire & Strand

AMERICAN STEEL & WIRE COMPANY

208 S. LaSalle St., Chicago Empire State Bldg., New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

SOLDERS
FOR EVERY PURPOSE

The Gardiner Line of high quality solders offers a complete service — there is a solder especially made for each particular type of telephone work.

Some of the more important kinds of Gardiner Solder used in telephone installation and maintenance are:

Acid-Core Solder for iron lines and lead-ins. Made in various gauges and with a scientifically uniform flux. Standard gauge No. 11, about ⅛" dia.

Flux-filled solders available in 1, 5 and 20-lb. spools.

Rosin-Core Solder for switchboard and other delicate work where absolutely non-corrosive solder is essential. Standard gauge No. 13 about 3/32" dia.

Bar solders made in various alloys.

Bar Solder, Wiping Solder, Ingot Lead and Lead Sleeving are all made of the best materials and to meet most every need.

Low prices are assured because all Gardiner products are made by the most modern methods and in large volume. Insist on Gardiner. Your jobber will supply you.

Gardiner METAL CO.

4840 S. CAMPBELL AVE. CHICAGO, ILL.

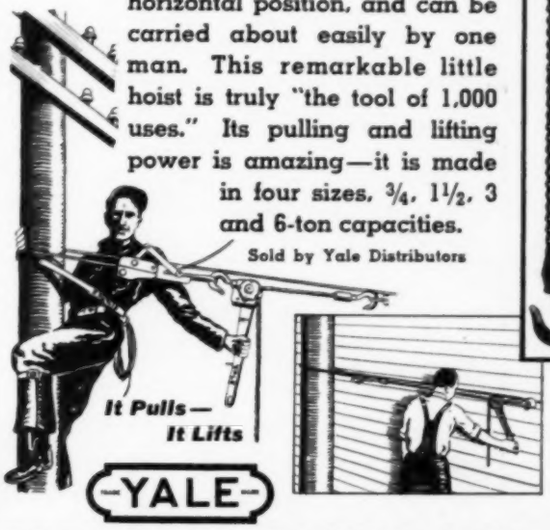
Established for over 35 years.

FOR THE TELEPHONE INDUSTRY

PUL-LIFT
The 'PIGMY' HOIST with a GIANT'S POWER

It operates either in vertical or horizontal position, and can be carried about easily by one man. This remarkable little hoist is truly "the tool of 1,000 uses." Its pulling and lifting power is amazing—it is made in four sizes, ¾, 1½, 3 and 6-ton capacities.

Sold by Yale Distributors



-YALE-

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION • PHILADELPHIA, PA.

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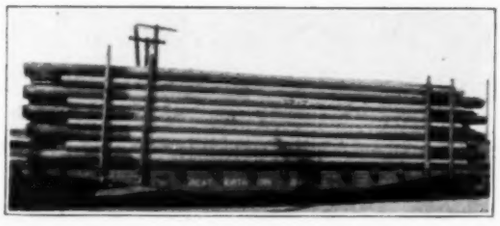
Quick Shipments!



1st Quality — Plain or Butt Treated

CEDAR POLES

Northern White — Western Red

NWCA — WRCA — AT&T or ASA SPECIFICATIONS

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Lumber Exchange MINNEAPOLIS, MINN.

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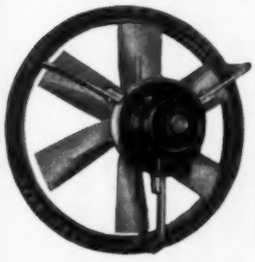
Heating and Ventilating Equipment
THE CHOICE OF THE NATION'S FINEST TELEPHONE ENGINEERS



AUTOVENT "31 Series" Propeller Fans

Installed in many Telephone Companies for exhaust ventilation, in Terminal Rooms or Operating Rooms.

Especially recommended for economical ventilation, where a large volume of foul air exhaust is required. Fan will not churn air or overload motor. Rugged construction—Low Cost! Capacities 500 to 38,000 cfm. Write for bulletins Nos. 200, 201, 202.

AUTOVENT Uniblade Volume Blowers

Installed by Telephone Engineers for correct ventilation in kitchen and cafeterias and also used for central ventilating systems. Handles low volumes at medium pressures. Motor Driven.—Universal Discharge! Other blowers for heavy duty ventilating, available in belt driven types. Write for bulletins Nos. 300, 301, 302.

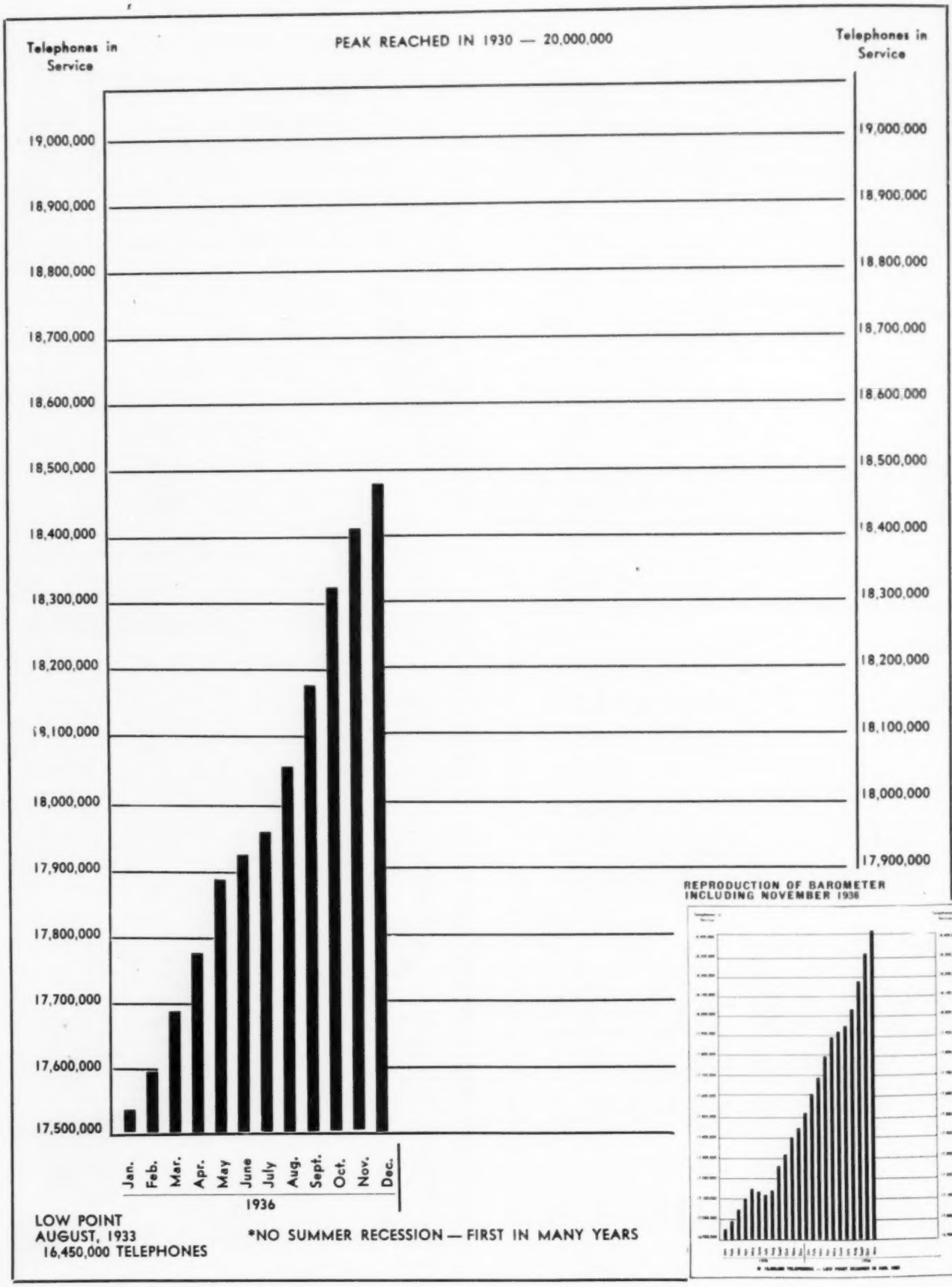
AUTOVENT Super-Type Unit Heaters

These suspended type steam unit heaters direct air to the lower part of the room. Available for heating rooms or spaces added due to expansion programs, and exceptionally efficient for heating new exchange buildings. (Also can be had with electric heating element.) Write for bulletins Nos. 101 and 400.

AUTOVENT FAN & BLOWER CO.

1805-23 N. Kostner Ave. Chicago, Illinois

Monthly Telephone Station Barometer



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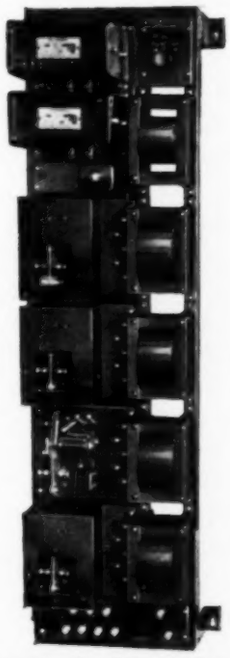
No. 90 C. B. Handset Telephone

LEICH ELECTRIC CO.
GENOA, ILL.

Leich Self Contained Handset

Construction — Rugged
Appearance — Beautiful
Light Weight — Stands Up

Universally Approved by Subscribers



Harmonic Converter

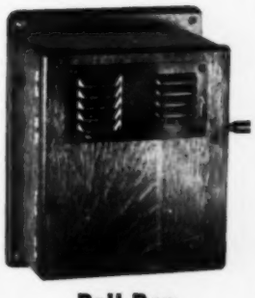
1. Steel Frame	Fireproof Panels Vacuum Impregnated
2. Transformers	Will Not Break Down
3. Vibrator	Adjustment Permanent
4. Circuit	Reduces Arcing
5. Battery Rectifiers	Increases Life With Or Without Charging
6. Frequencies	Any Combination Desired
7. Cycles	16—30—42—54—66 or 16-2/3—33-1/3—50—66-2/3

No. 70 Magneto Handset

No. 70 Magneto Handset

Constructed of the Finest Materials
Reduces Stock
Modernizes Present Equipment

Any Conventional Bell Box Can Be Used Or Equipped With Bell Box As Shown.



Bell Box

EQUIPMENT THAT STANDS UP

Editorial « « «

A Timely 1937 Buyers' Guide

This Buyers' Guide Number comes to you at a most opportune time. We say this because of the unprecedented rise in cost of materials needed by the telephone industry. Immediate use of the Buyers' Guide Section is suggested to those of you that need materials for the coming year. These higher prices for basic metals mean nothing else but HIGHER PRICES FOR ALL EQUIPMENT!!

In fact, the writer would like to call this to your attention more as a warning than a suggestion. Pole line hardware has already jumped 15% in price. Lead and copper, both basic metals for the industry, have listed gains of 25% and 20% respectively for the year just ended and it would not be surprising to those familiar with the upward trend of prices to see a price increase in not only line equipment but inside materials during the next 30 to 60 days. The price increases are justified and seem to be as sure to come as 1937 is to surpass '36. There is no alternative for the manufacturers; and telephone men with this in mind should take steps, right now, to survey their needs for the year and communicate with companies handling their particular wants, then order immediately.

Taxes just taking effect and others expected in the near future only strengthens our message and argument that immediate action is necessary if you want to take advantage of present prices and conditions in your favor.

So we say the Buyers' Guide Section comes to you at an opportune time. It is complete, up-to-date and simplified for immediate use. It is larger than the 1936 Directory and contains 48 pages of listings on tinted paper. Consult this ready reference at once and reap the benefit. Our pledge of last year, when the Buyers' Guide first appeared, has been answered this year by its acceptance by the trade, the manufacturers and telephone operating men. IT SHOULD REMAIN ON YOUR DESK FOR READY REFERENCE DURING 1937!!

TELEPHONE ENGINEER
MANAGEMENT - ENGINEERING - MAINTENANCE

JANUARY, 1937

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

Reorganization . . .

● The functions and personnel of the Federal Communications Commission would be transferred to the Commerce Department and the present Commission abolished under the drastic Government reorganization program which President Roosevelt has submitted to Congress.

In a nutshell, the reorganization of the FCC under the Commerce Department will mean the setting up of the Commission in two sections.

One would be an Administrative Section which would formulate rules, initiate actions, investigate complaints and hold preliminary hearings—in short, all the present regulatory and administrative actions of the present FCC. The other would be the Judicial Section which would sit as an impartial, independent body to make decisions based on records and findings presented by the Administrative Section and constituting an appellate body from the rulings of the Administrative unit.

The Administrative Section would be a regular bureau or division of the department, headed by a "responsible" chief with government career tenure and staffed under civil service, it is proposed by the President. The present staff of the Commission could with a minimum of disruption be molded into the Administrative Section. The present commissioners would assume the status of a judicial section.

The plans for drafting a bill to carry out the Reorganization plan have not yet been made. It is expected, however, that it will be tackled by a joint committee of the Senate and House with the aid of the President's Committee on Administrative Management.

● President Roosevelt asked that he be given the power to shift about the agencies and bureaus in the reorganization. It is believed that the entire revamping will take between two and three years. In his reorganization plan, the Chief Executive is hopeful of accomplishing better management and government with less duplication, overlapping and lost motion of governmental functioning.

The proposal of placing the Independent commissions, like the FCC, under regular departments was considered more revolutionary than any other portion of the President's program. But President Roosevelt in his message to Congress pointed to the committee's views that these independent regulatory commissions which perform administrative work in addition to judicial work threaten to develop a "fourth branch" of the Government for which there is no sanction in the Constitution.

The shifting of the Independent commissions to be under departments, it was stated in the Committee Report accompanying the President's message, would be done for "better management and better housekeeping". The Committee in designating the Commerce Department as the regular department to which the FCC would be transferred stated that under the new program the Commerce Department in addition to its present functions would "enforce laws with regard to manufacturing, merchandising, COMMUNICATIONS and transportation."

● Considerable criticism of the Independent regulatory commissions, such as the FCC, was directed at their present status and functions by the President's Committee. The commissions were described as constituting "a headless fourth branch of the Government, a haphazard deposit of irresponsible agencies and uncoordinated powers. They do violence to the basic theory of the American Constitution that there should be only three branches of the government. The Congress had found no effective way of supervising them. they cannot be controlled by the President, and they are answerable to the courts only in respect to the legality of their activities."

Citing their confusion of powers of both administrative functions responsible to the President and judicial functions, the Committee said that it would be more accurate to term the Commission as "irresponsible" regulatory commissions rather than "independent" commissions. It led to a situation of the commissions having power without responsibility, where the President had responsibility without

power in his relations with these commissions. "The commissions produce confusion, conflict and incoherence in the formulation and in the execution of the President's policies," the Committee report stated.

Then in an important comment on the status of the independent commissions, the Committee stated the following:

The Commissions "carry on judicial functions under conditions which threaten the impartial performance of that judicial work. The discretionary work of the administrator is merged with that of the judge. Pressures and influences properly enough directed toward officers responsible for formulating and administering policy constitute an unwholesome atmosphere in which to adjudicate private rights. But the mixed duties of the commissions render escape from these subversive influences impossible.

● "Furthermore, the same men are obliged to serve both as prosecutors and as judges. This not only undermines judicial fairness; it weakens public confidence in that fairness. Commission decisions affecting private rights and conduct lie under the suspicion of being rationalizations of the preliminary findings which the commission, in the role of prosecutor, presented to itself." (This criticism is similar to one presented by the American Bar Association in its report proposing an Administrative Court to pass regulatory commissions' decisions).

Under the Reorganization plan, the Committee stated that the regulatory agency "would be set up, not in a governmental vacuum outside the executive departments, but within a department;" * * * * the administrative section would be a regular bureau or division of the department, headed by a chief with career tenure who would be directly responsible to the Secretary and through him to the President; * * * * the judicial section would be "in the department" only for the purposes of "administrative housekeeping" for budget, personnel administration and material and would be wholly independent of the Department and the President with respect to its work and decisions, while its members would be appointed by the President with approval of the Senate for long staggered terms. The Committee declared that the plan created effective responsibility for the administrative and policy-determining aspects of the regulatory job and at the same time guarantees the complete independence and neutrality of the work of the judicial section. Under one department roof, too, division of labor and modifying of functions could be worked out by executive order.

● The Committee did not view the proposed plan as "revolutionary or dangerous" and stated that the idea of giving these phases of the administrative process which involve policy and discretion to a different agency from that which issues or makes decisions after the manner of a court is a very old one. The Committee cited as illustrations—the Customs Court, the Court of Claims and the Board of Tax Appeals. This segregation of function "lies at the heart of the proposed plan," the Committee report added.

A close scrutiny of the way in which the present more important regulatory commissions function, the Committee report stated, indicates that the division of functions between the proposed administrative and judicial sections "is merely a formalizing by statutory enactment of the division of labor that has already been set up within the commissions themselves." It was cited that in nearly every case the commissioners have already set up a division of labor, acting upon cases and issuing orders on the basis of records and findings prepared by the administrative staffs.

"It is difficult to see how the transition" of a transfer of the commissions to regular departments, the Report concluded, "could be very disturbing or why the plan should not work smoothly and efficiently."

Spend $300,000,000.00 In 1937

In testimony before the FCC, officials of the A. T. & T. stated that $300,000,000.00 would be spent during the year just starting in replacements, additions and betterment of the service, while being questioned during January hearings of the investigation.

Net additions to the plants of the Bell system companies in 1937 are expected to total in excess of $125,000,000 officials said. Gross expeditures for replacements, additions and betterments in 1936 totaled $243,347,999 and net additions totaled $73,150,000, it was announced.

Total increase in station installations for 1936 by the Bell companies are listed as 889,000 stations against a gain of 461,156 in 1935. The increase for December of 93,000 stations was the largest since 1929 except September and October when over 100,000 stations were reported.

Investigation Hearings Move at Rapid Speed . . .

● Concentrating on engineering subjects, including the cost of various major portions of the telephone plant, the FCC Telephone Investigation moved at a fast rate during December and January. The Telephone Division Commissioners. Paul A. Walker and Thad H. Brown, even gave up their Christmas holiday recess to hold a half dozen days of hearings in New York to conclude a probe into the activities in the motion picture field of Electrical Research Products Inc., A. T. & T. subsidiary.

The most important proceedings of the investigation occurred during the latter part of December upon the subject of the Bell System charges for the use of telephone hand sets. This study was considered a "trump card" of the investigation and won favorable newspaper editorial comment in many leading newspapers. In several states, the governors and state commissions also instituted separate inquiries into the charges as a result of the FCC disclosures, one of the outstanding moves in that direction being taken by Governor Lehman of New York in his inaugural address.

The FCC investigation witnesses charged that the hand set had produced estimated ultimate savings in wire construction costs calculated at $85,391,000, which should have been the basis for reduction of subscribers' rates rather than a source for imposing extra charges on the users of the instruments.

● The FCC testimony, which was mainly given by C. L. Terrel, who cited that he had served with Western Electric for four years, two of which were during college summer vacations, charged that the A. T. & T. and Bell System companies through monthly charges for use of the hand sets had collected from subscribers between 1927 and 1936 total revenues of $53,240,000 which brought in an alleged net profit of nearly $24,000,000. This purported net profit amounted to 45 per cent profit on gross revenue, according to the FCC engineer, and an annual return of 25% on the average annual investment during the ten-year period.

By a series of computations through the combination of purported net profit of $23,895,000 with the Bell System's added expenses of maintenance and operation for the hand sets, the Investigation staff charged that, even though all the present extra monthly rates for the use of the handsets were eliminated on Jan. 1, 1937, that $24,000,000 net profit would be sufficient to defray all added future expenses of the handset until 1950 and still would leave a remaining profit of $11,527,000.

● The Investigation engineering staff compiled a table showing the extra

(Please turn to page 112)

Telephone Transmission
Theory and Practice

By ROBERT A. CLARK, JR.

CHAPTER XII

The characteristics of telephone lines and the design of balancing networks for telephone repeaters are discussed in this chapter.

● You will recall in Chapter XI that for efficient operation of telephone repeaters we must design a network which will closely match the telephone line throughout the voice frequency band. In previous discussions we have mentioned that good voice transmission will be obtained if the transmission frequency characteristics are maintained constant (or approximately so) between 200 and 2,000 cycles. If the band is extended up to 3,000 cycles an appreciable improvement in intelligibility will be obtained. However, with the trend towards the more efficient use of telephone wires by means of carrier current applications it appears desirable in most cases at least, to design our telephone lines and circuits to pass the 200-2,000 cycle band rather than attempt to obtain the improvement in quality by extending the range to 3,000 cycles or higher. Actually, if we design circuits to pass 2,000 cycles, frequencies higher than this will be passed to some extent. This obviously gives some improvement in quality as compared to a sharp cut off at 2,000 cycles.

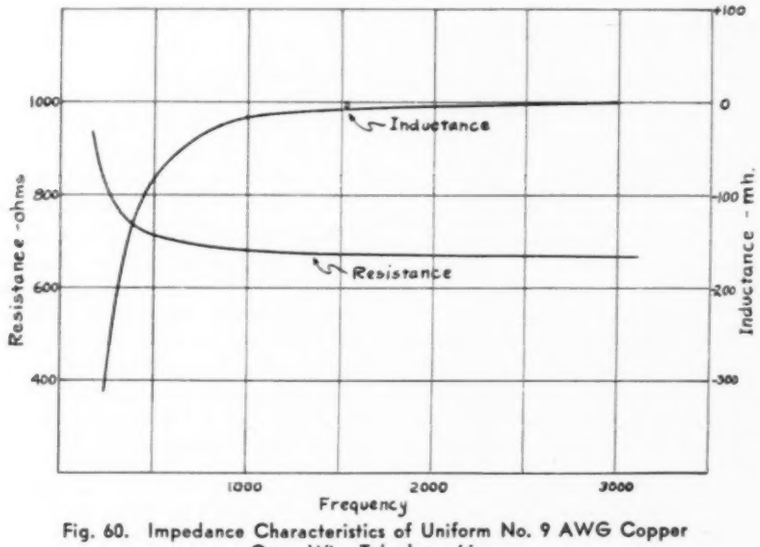


Fig. 60. Impedance Characteristics of Uniform No. 9 AWG Copper Open Wire Telephone Line.

The schematic diagram shown in Figure 58 for a telephone repeater does not include any filter circuits for limiting the frequencies to be amplified. Filters for such purpose vary in type and characteristics over a wide range and we will not attempt at this time to discuss them specifically. In fact with proper design of the transformers the repeater can be given characteristics such that additional filters are not required for most applications.

We will devote our discussion in this chapter primarily to the characteristics of lines which are commonly used for long distance telephone transmission and networks which will simulate these lines throughout the voice band. In measuring the characteristics of a telephone line we employ an alternating current Wheatstone bridge and a variable frequency

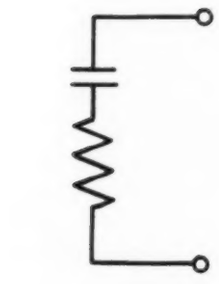


Fig. 61
Network For Balancing Open Wire Telephone Circuit.

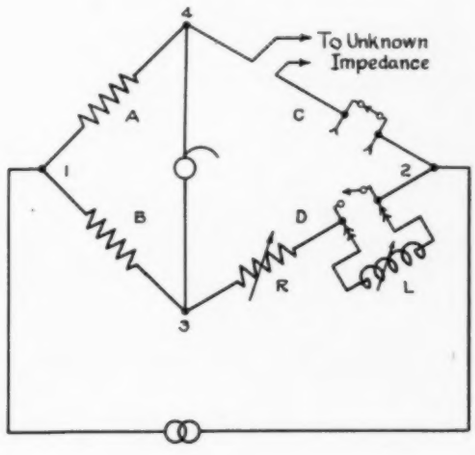


Fig. 59. A-C Impedance Bridge.

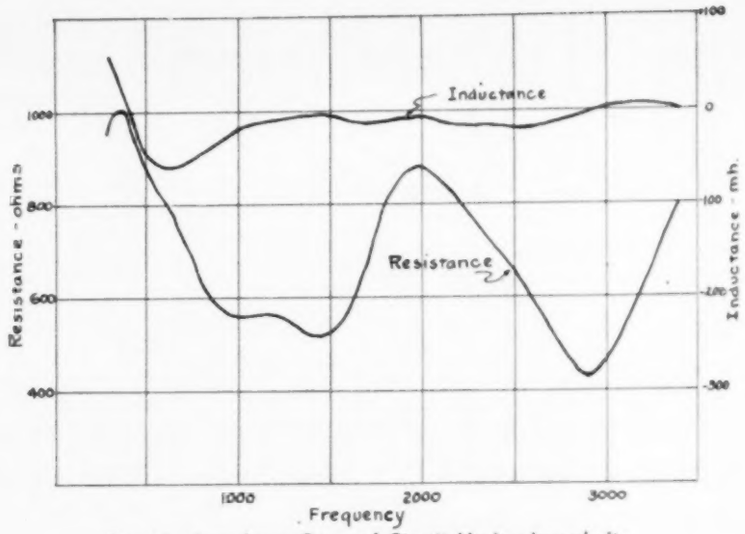


Fig. 62. Impedance Curve of Circuit Having Irregularity Caused by Repeating Coil.

oscillator. The circuit for such a bridge is shown in Figure 59. This bridge operates on the same principle as the D-C Wheatstone bridge with which you are all undoubtedly familiar. However, we will briefly describe the a-c bridge which has a few additional features. Referring to the diagram you will note that there are four arms in the network, A, B, C and D. Arms A and B are non-inductive resistances each equal and having a resistance of approximately 1,000 ohms. For accurate work the two resistances should match within 1 ohm. Arm C extends to the telephone line or other equipment to be measured. Arm D consists of a variable inductance and variable resistance. For telephone measurements the variable resistance should be continuously variable up to about 10 ohms and in steps to permit reading resistance components up to as high as 10,000 ohms. The inductance should be continuously variable and should permit adjustment to within one millihenry. It should be capable of reading values as high as about 1 henry.

● A variable frequency oscillator is connected to terminals 1-2 and a telephone receiver to terminals 3-4. The oscillator is adjusted to a given frequency, and the variable resistance and inductance adjusted until no sound is heard in the receiver. Under such conditions the resistance and inductance components of the unknown which is connected to arm C is equal to the known resistance and inductance in arm D. You will note a switching arrangement in arm C and D which permits the known inductance to be connected in series with the unknown in arm C, thus obtaining a balance when the unknown has a capacity component of reactance. Referring back to our discussion of reactance in Chapter III you will recall from formulas 14 and 15 that the reactance of a condenser can be made equal to the reactance of an inductance at a given frequency or vice versa. As the two are opposite in phase relation, one neutralizes the other and we have left only a pure resistance component which in the bridge arrangement would be balanced by resistance R in the arm D.

In making impedance measurements on lines we start at a frequency of about 200 cycles and obtain a bridge balance at intervals of about 100 cycles up to about 2500 cycles. Where it is necessary to insert the known inductance in series with the unknown (arm C) the impedance characteristic is said to be negative. This is merely for convenience in plotting impedance curves. When the known inductance is in arm D for balance the impedance of the unknown is said to be positive.

● Let us now look at some typical impedance characteristics of a long telephone line consisting of No. 9 AWG copper wire. By long we mean either a line which is of infinite length or one to which is connected a network having impedance characteristics similar to a long line. You will note that throughout the entire frequency range, the reactance is negative. In other words the known inductance would be in the C arm for all readings. For such a case it would have been possible for us to obtain a balance by using a condenser in the D arm in place of the inductance in the C arm. If we were to do so we would find that a condenser of approximately 2 mf would enable us to obtain a balance throughout the frequency range. Those of you who are mathematically inclined may verify this by solving equations 14 and 15 (Chapter III) to see what value of capacity is required to equal the measured inductance at the different frequencies.

We may therefore conclude that a resistance of approximately 675 ohms in series with a condenser of approximately 2 mf capacity will provide a balancing network for a non loaded open wire line. We would find on measuring lines consisting of other size conductors that the equivalent capacity is quite similar. With the larger gauge wire the resistance component will decrease somewhat dropping to about 600 ohms in the case of No. 8 BWG copper wire. Figure 61 shows a network suitable for balancing open wire lines. As mentioned above the capacity should be approximately 2 mf and the resistance from about 600 to 700 ohms depending on the line characteristics.

You will observe that the line characteristics do no match the network very closely at frequencies below about 400 cycles, the resistance component tending to increase appreciably. It is possible to add a parallel resonant circuit to the network in series with the condenser and resistances shown in Figure 61 which will more closely simulate the line characteristics. However, in general this is

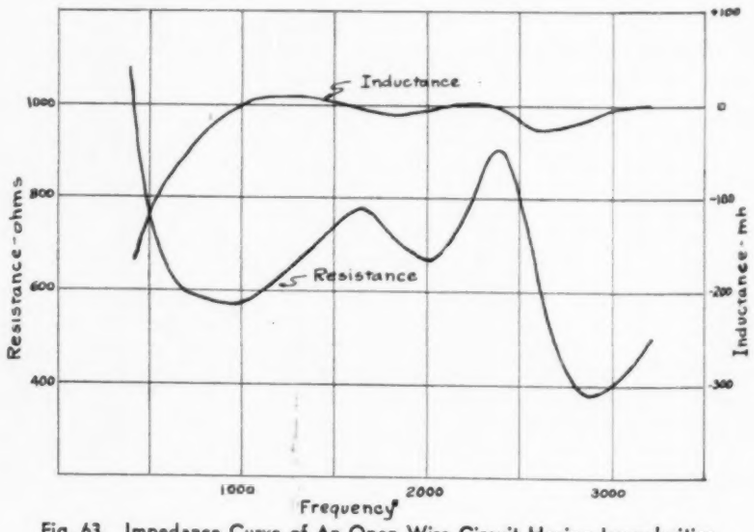


Fig. 63. Impedance Curve of An Open Wire Circuit Having Irregularities Caused by Short Sections of Nonloaded Cable in the Line.

not necessary and the network shown in the figure proves suitable. To partially offset the unbalance between the line and network the gain of the repeater may be reduced at frequencies below 400 cycles so that there will be no tendency to sing. This can be accomplished readily by means of a high-pass filter section inserted in the input section of the amplifier, for example, between the CL18 transformer and the 1221 transformer (Fig. 58). Similarly if for some reason such as the use of carrier equipment, the network does not simulate the line characteristics at the high frequencies a low-pass filter section may be inserted to drop the gain.

In practice, we find that the ideal line characteristics shown in Fig. 60 are seldom obtained. This may be due to any of several causes. The most common one is the insertion of short sections of non-loaded cable in the open wire line. Also, there are many circuits with short taps consisting of a few miles of open wire extending over to a bridged telephone. Anything which tends to change the line characterstics from that shown in the figure is known as an **irregularity**. The effect of such irregularities are mainly to prevent the operation of repeaters at high gain.

For example, if a repeater ware inserted between two sections of open wire each 200 miles in length and having no irregularities we could operate a repeater at a gain of at least 15 db. However, if there was a two mile section of non-loaded cable in one of the open wire lines a distance of 100 miles away from the repeater we might find it possible to obtain a gain of but 10 db. In other words, for good repeater operation we must have lines that are uniform in characteristics and which do not have any irregularities. There are various schemes we can use to obtain uniform line characteristics. For example, loading coils can be installed in cable sections so that the cable will have the same characteristic impedance as the open wire. Way stations, that is bridged telephones along the line, can be modified so that they have a comparatively high impedance. Such a telephone when bridged across the line will have comparatively little effect in changing the line characteristics. A simple scheme for modifying such telephones consists of merely inserting a 1,000 ohm resistor in series with the telephone. This opviously reduces the transmission equivalent to and from the station. However, in most cases this can be tolerated.

● It is interesting to see just what effect irregularities have on the impedance characteristics of the line as measured by the bridge described above. The impedance curve tells us first where the irregularity is and second, how much gain can be obtained from a telephone repeater without singing. This latter feature is somewhat involved and we will not take time to discuss it in this chapter. However, the use of the impedance bridge to locate irregularities is important and it is very desirable to have curves for all circuits involving repeater operation. Fig. 62 shows the impedance characteristics of a No. 9 AWG open wire circuit approximately 150 miles in length which contained a WE Co. type 70 repeating coil 50 miles away from the test point. This repeating coil has a comparatively high equivalent series reactance and therefore has an appreciable effect on the line impedance when used to connect two open-wire sections together. You will observe, that the equivalent inductance and resistance vary in the form of a wave motion above and below the nominal smooth line value. There is a definite relation between the distance to the irregularity from the test point and the frequency difference peaks or nodes of the impedance curve. Knowing this relation, we can compute with a fair degree of accuracy the distance from the test point to the irregularity. The formula for this relation is

$$D = \frac{V}{2f} \qquad (35)$$

Where **D** is the distance from the test point to irregularity in miles, **V** is the velocity at which alternating current travels over the telephone line which on open wire lines is about 180,000 mi. per sec., **f** is the distance in cycles between adjacent peaks of the impedance curves. This value should be obtained by averaging the distances between all of the peaks occurring on both the inductance and resistance curves. In the case of the curve shown in Fig. 62, we find that this average is 1700 cycles. Solving in equation (35), we find that the distance to the irregularity computes to be 53 miles away from the test point; actually it was 51 miles away. Such an irregularity as shown in Fig. 62 could be eliminated by replacing the type 70A coil with a high efficiency low impedance repeating coil.

The effect of two short sections of cable in a 100 mile wire line is shown in

(Please turn to page 107)

"Ask her if she's got a friend"

NED HILTON
Courtesy "Colliers"

Association President F. B. MacKinnon Dies

Frecerick Benjamin MacKinnon, 64, executive head of the United States Independent Telephone Association for the past 23 years, succumbed to illness at his home in Kenilworth, Ill., January 10th. The suddenness of the stroke, with death following a few hours later, left a mourning circle of friends extending to all corners of the country. Only confidants were aware that Mr. MacKinnon was not in the best of health as he was carrying on even two days prior to his death.

A native of Concordia, Kansas, Mr. MacKinnon entered the telephone business around the turn of the century to become manager of the Lawrence Home Telephone Company, Lawrence, Kansas. He was connected with another telephone company in his native state immediately following, being president and manager of Suburban Telephone Company, but retaining his residence in Lawrence. His steady rise in the telephone industry gained him many friends and in 1912 the Kansas Independent Telephone Association drafted him as secretary of that association.

In that position he laid the groundwork to his life's work. Representing his association in Topeka, the state capitol, to appear before the Public Utilities Commission his worth was recognized by the telephone industry who in turn drafted him in late December of 1913 to become secretary-treasurer of the National Independent Telephone Association.

During the war years from 1914 to 1919 his service to the Industry was invaluable as during that period the government took over operations of all telephones with Mr. MacKinnon serving his Association in Washington, D. C. He in turn served his country with his wonderful assistance to the signal corp. His service and accomplishments during this period of strife was handsomely rewarded.

Selected as president of the United States Independent Telephone Association following the consolidation of the two national associations several years earlier, his service to the industry starting in 1919 was to bring him his well earned recognition from the entire United States. Bringing the Independent group into more effective relation with the Bell group and causing enactment of important legislative matters, the association under his leadership has grown into one of the finest organizations of its kind. His advice and assistance in the late twenties saved many telephone men and companies through his stringent regard to economic values.

Frederick Benjamin MacKinnon
July 1872—January 1937

Having all attributes of his high position, his kindly generous personality won him many friends with a resultant reputation of knowing more telephone men personally than anyone in the Industry. His zeal for the Industry led him as principal guest to many conventions where his earnestness was rewarded by his results in bringing harmony through all the country. These attributes with the regard and love to his family and church caused the minister at his funeral to deviate from the regular ritual that he might utter the kindest and simplest words the ministry can bestow, "He was a good man".

Surviving are his widow, the former Cecil Leland of Eldorado, Kans., two sons, Cyrus Leland, a student at Dartmouth, Frederick Benjamin Jr., senior in high school, and a daughter, Miss Cecilia, now attending Sweetbriar College. A sister, Mrs. Edward Fitch of New York state; and two brothers, D. S. of Milwaukee, and A. R. now serving as secretary of the New York State Telephone Association.

Pallbearers serving at the funeral services January 12th held at the family home were Charles C. Deering, Edward C. Blomeyer, Bob W. Anderson, Stanley R. Edwards, Dudley W. French and David K. Hall.

Resolution of the Association

WHEREAS

The term of office of F. B. MacKINNON as President of the United States Independent Telephone Association was ended January 10, 1937, by a Power from which there is no appeal; and

WHEREAS

FREDERICK BENJAMIN MacKINNON was President of this Association for almost twenty years. In the history of the Independent Telephone industry there has been no other man so peculiarly well qualified to render his great and valuable service to this organization and to the industry it represents. Under his wise and able leadership the Association has been of incalculable value and benefit to its members and to the industry during momentous years, including trying times of war and of depression as well as those of prosperity and of peace.

He established the policies of the Association wisely and administered its affairs ably; he maintained its high prestige throughout all the years of his incumbency. He was a major factor in establishing and maintaining the amicable and constructive relationship now existing between all of the groups of the telephone industry in this country.

He was always helpful, always cheerful, always rendering constructive service. He gave his talents and ability unsparingly upon even the smallest problems of those who needed his counsel. There is no one who can find the place he established for himself in the telephone industry and in this Association.

His loss will be felt for many years and he will be mourned throughout their lifetimes by the thousands of friends, both within and outside the industry, who enjoyed his companionship, respected his ability and admired him as a man.

The Executive Committee of the Board of Directors of the United States Independent Telephone Association, in special meeting, while realizing the futility of words, has respectfully prepared this tribute to FREDERICK BENJAMIN MacKINNON on behalf of the Board, the officers and the members of the Association, and has unanimously

RESOLVED

THAT this resolution be made a part of the permanent minutes of the Association, and that it be given publication, and distribution to the membership, and

THAT a copy hereof, suitably engrossed, shall be presented, with the heartfelt sympathy of all members of this Association, to the bereaved family of FREDERICK BENJAMIN MacKINNON.

(Please turn to page 110)

Portable Electric Tools for Telephone Work

By RAY BLAIN

Smaller details around the plant have their place in major incidences, so this dissertation by Ray Blain, with photographic illustrations by the author, on the value of portable instruments is offered our readers from actual experience.

● It is not believed that the average telephone company fully realize the numerous advantages which may be gained from the proper use of good portable electric tools now available. Not only are these tools useful in the telephone exchange but they may also often be used to good advantage out on the job. Electricity is now available almost everywhere and seldom will anyone object to having a portable tool

Portable electric drill in stand used as drill press.

connected to one of their light sockets for a few minutes if it will ease the labors of a hard working telephone man.

We have constructed some special reels which carry extra long, rubber covered extension cords for use with portable electric tools. One end of the cord is attached to a socket which is mounted in the top of the reel. This reel is located where the portable tools are to be used and the cord pulled-out until a light socket is reached when it is connected. The portable tool is then plugged-in the socket on the reel. This reel arrangement keeps the extra long extension cords free from tangles and available for instant use at all times.

● We are of the opinion that the Electric Hammer drill is one of the greatest labor savers of all time. A good hammer drill will often pay for itself in labor cost alone on one small job. One man with a good electric hammer drill can do more work than a half dozen men with hand drills, in the same length of time. When cleating cable to a wall the drilling of holes is a simple and easy task with an electric hammer. Also when a cable must enter a stone or brick building the entrance hole can be drilled easily with a long drill of either the hollow or star type.

The electric twist drill is also most useful in any telephone exchange. We have one small and one large size and make use of them frequently to good advantage. A wood bit can be placed in an electric drill and used by installers in drilling holes through walls and floors in frame buildings. These power drills will get into corners or close to walls and eliminates the need of a corner brace. We also have a stand which is used to make a drill press of the large electric drill.

● Recently we had a number of timbers to drill in connection with bridge clamp to use on a river crossing. Another time it was necessary to construct a number of special crossarms and complete them with the least possible delay. A 5/8 inch bit in the drill press drilled all the holes in the bridge clamps. A special 1¼ inch bit was purchased and the holes for the pins in the crossarms were bored with accuracy, ease and speed. These drills are used frequently on numerous special jobs, all of which saves both time and money.

A combined Electric Hammer and drill may be obtained if desired. The electric drill part of this tool is of the conventional type and uses ordinary twist drills in metal. Less than one minute is required to clamp on the hammer member which strikes 2400 hard blows per minute. This hammer though light in weight is rugged in construction and will handle all ordinary telephone work with ease. A light weight electric hammer is desirable as it can be handled more conveniently by the man operating it and is much safer when operated from the top of a ladder.

Using combination electric hammer drill.

Using portable paint spray.

This combination drill outfit also has grinding and buffing attachments which may be used to advantage frequently. A special clamp quickly converts the drill into a bench grinder or buffer.

● The portable electric planer and sander is another modern tool which most surely pays its way. This machine does fast accurate wood cutting, also sands a surface smooth and clean much quicker than it possibly can be done by hand. We always use the sander to good advantage in removing old paint from a line or trouble truck. There is also a sheep skin buffer attachment which can be used to advantage in waxing and polishing all autos and trucks.

Recently we purchased some extra long cedar poles and while they were of excellent quality they did have numerous knots which required considerable smoothing down for appearance sake. We tried a draw-knife and a hand axe both of which were slow and with them it was impossible to do a smooth job. Then someone thought of the electric planer and it soon proved the perfect answer to our difficulty. Just one lick with this tool and the knot disappeared completely, leaving a surface as smooth as the remainder of the pole.

One man and a planer completed more work in an hour than four men could have done in a day with hand tools, also much better. We have found this planer useful in the construction of battery racks, headset cabinets, bulletin boards and even the refinishing of switchboard cabinets.

● The portable electric grinder is another good tool so often neglected by telephone people. There are so many odd jobs which can be done so easily and quickly with a good grinder which are so slow and expensive when attempted with a file or other hand method. These electric grinders can be fitted with rag and wire buffing wheels in addition to the various grades of grinding wheels. The buffers are useful for removing rust and in polishing certain kinds of tools.

Recently on a large underground cable job considerable difficulty was experienced in keeping the shovels sharp. We were short of tools and considerable time was lost in taking them to the nearest blacksmith shop. The portable grinder came to the rescue for we set it up right out on the job and a shovel could be made almost as good as new in just a few minutes. After that we set the grinder up each day and went over all the shovels. Only about 30 minutes daily was required to remove all nicks and keep our shovels in good condition at all times.

● Last, but in no small measure least, a small electric portable paint spray completes our set of labor saving tools. This spray if used properly, on most kinds of work, does a much better and quicker job than possible with the old-fashioned hand brush method. This spray has a small compressor belt connected to the electric motor and the complete outfit is small and light in weight. This spray can be successfully used by anyone after only a few minutes practice.

Recently we had a large number of outdoor type ironclad mine type telephones to repaint. This was a slow, tiresome job with a brush, and always looked streaked when finished. We then mixed the aluminum paint a bit thinner, cutting it down with turpentine and found that it worked perfectly in our paint spray. When painted in this manner the phones and their supporting standards had the appearance of aluminum castings the paint was so smooth. We also make use of the spray to paint cable terminals, pole balconies and wood guy guards. This spray is also a real help in the repainting of our cable trailers and line trucks. Only about an hour each month with the spray was required to touch-up the paint on all motor equipment. This is effort well expended for the covering of small scars and paint damage not only keeps equipment looking better but prevents wasteful rust.

Portable planer used to smooth knots on large cedar poles.

● Some telephone men may be of the opinion that electric tools are too expensive to be considered for their particular work. This will prove entirely wrong for while the first cost may be high, if given reasonable care these tools will last for many years. It is surprising also how soon even the most expensive tools will pay for themselves. The labor saving is only one factor which must be considered, for the superior grade of work it is possible to perform with them is something which just cannot be ignored by anyone who appreciates a job well done. Any telephone company will do well to investigate present day portable tools and determine which of them can be worked into their daily routine to advantage and profit.

Freeport, Texas.

Telephone Engineer,
Chicago, Illinois.

Dear Mr. Smith:

To date the writer has not received the December issue of Telephone Engineer.

Do not want to miss the combined articles you have been running, very interesting. About the only way the writer can keep up-to-date with the industry is thru trade papers as we are far away from the large centers. I file all of your issues so can refer to them and if any new dope is put out can look it over and see if it fits in my business.

Weather fine and clear. As W. U. the R. R. and Sulphur company work in conjunction with one another the new poles being placed now will allow me to use them later on. Fishing is good too. Wishing you a Merry Xmas and Happy New Year, I am,

(Signed) E. D. Selmser.

Inductive Coordination and the Rural Electrification Program

By L. J. CORBETT

This timely article will be of much interest to all telephone men having problems with the Rural Electrification Program now progressing. The author is well known, having written a number of treatises during his engineering career.

IN the extension of electric power distribution circuits in suburban areas, now being fostered to a greater extent than ever before, in the Rural Electrification movement, many situations arise in which these circuits are forced by economic factors into rather close physical relationship with telephone circuits already serving those areas. In some instances the power and telephone circuits are carried on pole lines on opposite sides of the roadway. They may be "joint" on the same poles, or the power line may overbuild the telephone line irregularly. The power circuits are not affected appreciably by such juxtaposition, but the operation of the telephone circuits may be adversely affected unless care is taken in planning the work.

Serving power to a sparsely settled rural area at a reasonable cost calls for different types of line construction from those which are common in urban territory where loads are heavy and profitable. Methods are sought to lessen the construction cost with the least sacrifice to safety, and with avoidance of too heavy maintenance expense.

● More chances are taken with communication lines than with power lines, as no electrical hazards are involved. If one wire of a communication circuit breaks, only one circuit is affected, and the few subscribers on that circuit are temporarily discommoded in their use of a comparatively inexpensive service. If the power circuit fails, the electrical hazard may be considerable, and may involve shutting off several users of appreciable blocks of power, thus interfering with scheduled operations, as well as the delivery of power load, and also, it may introduce a hazard, of fire, personal injury, or life, on other power or communication circuits, depending upon the circumstances of the failure.

Though at times a communication service may be of considerable value, admittedly its average value is far lower than that of the average power service, both to customer and company.

The physical hazard is provided against so far as is economically practicable by the modified line construction rules now applying in several state commission jurisdictions, so attention will be given here to the inductive coordination features, with only such reference to construction as may affect them.

● To most readers of TELEPHONE ENGINEER an understanding of the fundamentals of induction may be taken for granted. That current in a conductor is accompanied by a magnetic field in the surrounding medium, always varying with the value and direction of the current; that voltage is induced in any conductor in a changing field, proportional to the rate of change; that voltage on one conductor induces an electric charge of opposite sign of any other conductor in the vicinity, always proportional to the instantaneous value of the inducing voltage; and that current will flow through any completed circuit if a voltage is applied or induced in any part of it—these are fundamentals which are treated in more or less detail in books on electrical engineering, or, specifically, on inductive coordination.

When a communication circuit parallels an alternating-current power circuit, effects are produced from the current (magnetic induction) and from the voltage (electric induction) of the power circuit. At times one effect or the other predominates; the complete effect is a combination of the two.

● **Transpositions,** or relative interchanges of position of the conductors of a circuit, are used to nullify, so far as practicable, the inductive effects.

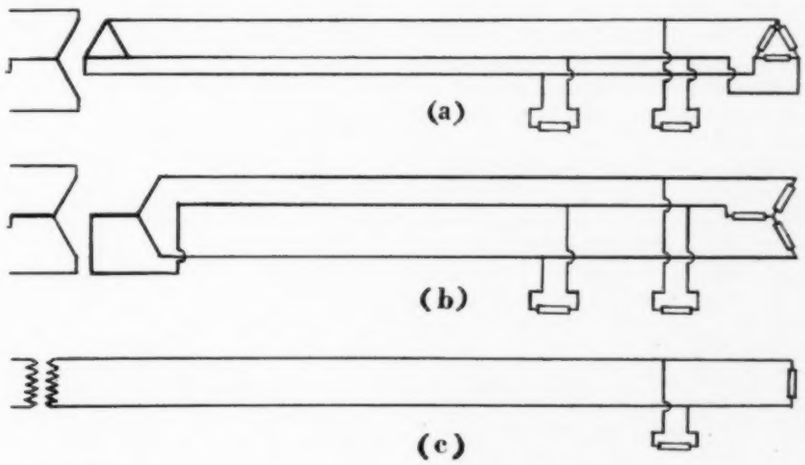


Figure 1.

Power Circuits Normally Balanced

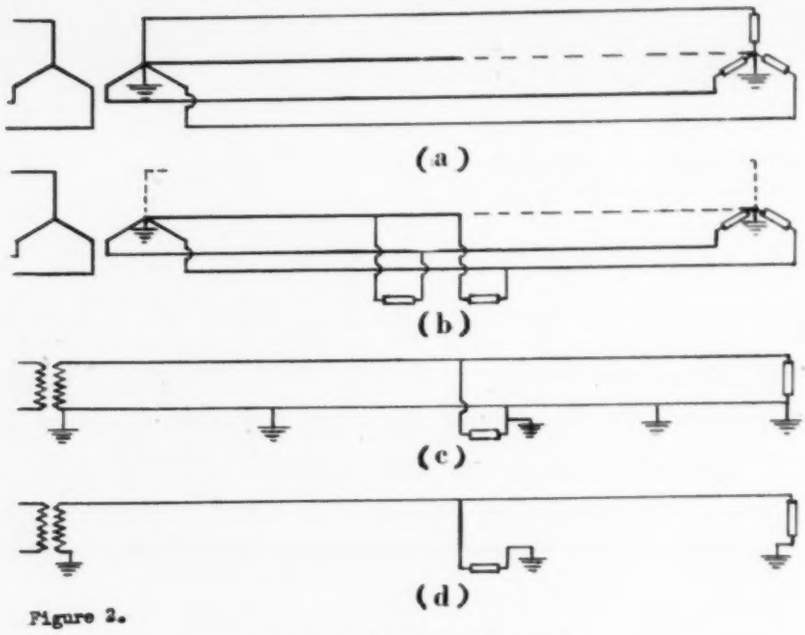


Figure 2.

Power Circuits Normally Unbalanced

In power circuits with certain connections transpositions may be installed in such a way as to reduce the total resultant induction on a parallel conductor to zero. With other connections of the power circuit, transpositions in that circuit are not fully effective. Transpositions may be installed in a metallic (two-wire) telephone circuit so as to equalize the induction in the two conductors, thus reducing the tendency for induced current to flow from one to the other through connected receivers, causing noise. Transpositions cannot, of course, be installed in a "grounded" circuit, consisting of a single wire with ground return.

In inductive coordination we have to deal with "balanced" and "residual" voltages and currents on a power circuit, and their effects upon a telephone circuit exposed to it.

Balanced currents in a power circuit are those currents which are confined to the wires of that circuit. Residual currents are those components which use the wire or wires (in parallel) as one conductor and the earth as the other conductor, of a circuit.

● Balanced voltages are those whose instantaneous values at each instant add (algebraically) to zero, and whose vector sum is zero. Residual voltages are the vector sums of the voltages of the conductors above ground.

We use the terms "currents" and "voltages" here because we are actually dealing with currents and voltages of various frequencies, which are combined in the main current and voltage of the power circuit. Some of these are ordinarily balanced, and some become residuals when certain connections are used. In detailed studies certain refinements in these statements are necessary for some conditions, but the above definitions will serve our general purpose here.*

Power circuits which are practically balanced are those completely isolated from ground, such as [Fig. 1, (a) and (b)] three-phase circuits from delta or isolated-Y connections, serving three-phase delta- or isolated-Y-connected loads or single-phase loads across the phases; and [Fig. 1 (c)] circuits from pure single-phase connections. Here current flowing out on any one wire returns on the other wire or wires.

● Lines may become more or less unbalanced as to current or voltage or both, when the circuit is at any point connected to ground. Such are: a three-phase Y-connected line with grounded neutrals [Fig. 2 (a)]; a circuit consisting of two wires of such a circuit, with or without a neutral conductor [Fig. 2 (b)]; a single-phase circuit consisting of one phase wire and a neutral wire having one or several ground connections [Fig. 2 (c)]; and (completely unbalanced) a single-phase circuit consisting of one phase wire with ground return, [Fig. 2 (d)].

When a three-phase line has a neutral connection to ground at the source end only, the **current** may be balanced, but residual **voltages** may be present. If there are other points on the neutral wire connected to ground, at the loads or elsewhere on the line, any unbalanced load current will flow through the earth, as will also any currents of the third-harmonic frequency and its odd multiples which may be present.

● If a power circuit carries only balanced currents, both the magnetic and electric fields, due to the currents and voltages respectively, are nearly zero at ordinary roadway separations or

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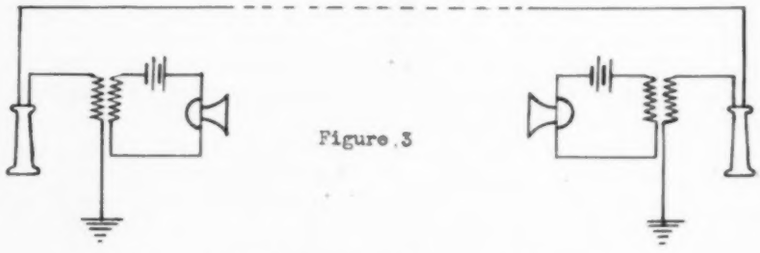

Figure 3

Grounded, or Ground-Return Telephone Circuit

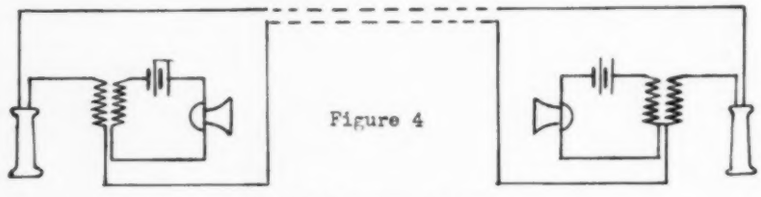

Figure 4

Metallic Telephone Circuit

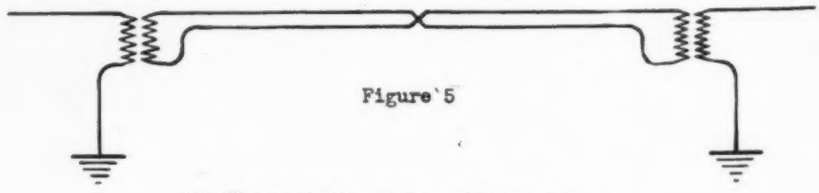

Figure 5

Metallicized Section of Ground-Return Circuit

Who Pays The Bill?

By J. H. Agee

This timely discussion on cost and accounting following construction to reduce inductive interference is by the new head of the United States Independent Telephone Association, having succeeded the late F. B. MacKinnon.

●At the last National Convention of the United States Independent Telephone Association, held the middle of October, this year, one of the very live topics which attracted a great deal of attention, particularly in the plant division, was the subject of inductive interference following the widespread program of the Rural Electrification Administration (R.E.A.).

Some interesting figures were presented. Mr. A. L. Stadermann, Chief Engineer of the Citizens & Independent Telephone Company, of Terre Haute, stated that in the first six months of 1936, 71,243 farms were supplied with electric service, making a total of 860,000 farms through-out the United States which were now using electric current. During the year the R.E.A. had approved loans in excess of $23,000,000 to various cooperative electric distributing companies throughout the country and under the program announced by the National Administration the ultimate goal would be to make electricity available to every farm in the country.

● This intense development of electric distribution spells a good deal of trouble for the telephone industry, more particularly in those sections of the country where grounded telephone service is still predominant. Statistics are not available covering the number of rural subscribers in the United States who are being served with grounded telephones but probably a fair estimate would be that 50% of the rural phones, including rural subscribers on the Bell System are still supplied with grounded service.

The subject of inductive interference is far from new. All telephone companies have been confronted with the problem of making their grounded lines metallic and providing proper balances whenever any power company energized a power line, whether for general transmission purposes from town to town or for the purpose of supplying rural subscribers with electric energy.

Heretofore the cost of converting a grounded line to metallic has generally been borne by the telephone company. Rates have been adjusted accordingly and the only item of cost which the power company has borne has been the cost of moving existing lines from one side of the road to the other or any other expense incident to such change which would properly be charged to maintenance or expense. The practice has not been to ask the power companies to make capital investments for the telephone industry.

● However, the present program of rural electrification is on such a broad basis that it reaches the smaller communities, many of which are served by mutual telephone companies or com-

J. H. AGEE
Acting President United States Independent Telephone Association succeeding the late F. B. MacKinnon

panies with limited financial resources. Introduction by the power people of the use of uni-grounded or multi-grounded neutrals in wye-connected circuits in rural power and distribution lines has aggravated the amount of interference reflected in the grounded telephone lines. All over the country the smaller companies have rushed to their Commission asking for protection or relief from interference with their service.

Confronted with the fact that such partially grounded electric lines will actually make it impossible for the telephone companies to longer furnish grounded service, the immediate and primary question then becomes, "Who will pay the cost of 'metallicizing' and balancing the telephone lines?"

At the Convention in Chicago many answers were given to this question. The first one seemed to be, "Let the power companies pay the cost." In several states Commissions had already indicated their willingness to make such orders and in one case before the Nebraska Commission such an order had been issued and was being complied with by the power company. There seemed to be a majority opinion favoring that procedure.

● Another suggestion was for the telephone company to pay the bill in the first instance and then spread the cost over a period of months to the subscriber, letting him reimburse the telephone company and after doing so, then to continue providing him with metallic service at a grounded rate.

Other suggestions were to divide the cost with the power company, playing the part of the big brother to the power company.

Regardless of the motives back of these suggestions, it seems to us that there is only one proper and sound solution to the problem and that is for every telephone company which operates grounded lines or lines with certain types of ground connections, such as push buttons on metallic lines, to do its own converting and make its own changes which affect the investment in telephone property. The reasons for this become apparent after a little study.

● For example: Suppose the power company distribution system parallels one hundred miles of rural lines in a community with grounded telephone service. Assume $25.00 per mile is the cost of making the telephone line fully metallic. The total additional investment would be $2,500.00. If the power company pays this bill, it has con-

A night panorama of the recently completed San Francisco-Oakland Bay Bridge. The Pacific Tel. & Tel. building is shown on the extreme right beautifully illuminated. Ground broken on July 9, 1933, the completion in 1936 broke world records. It is the longest in the world, being 8¼ miles; it necessitated removal of submarine cable by the above mentioned telephone company; 70,000 miles of wire used for two strands of 28¾ inch cable; specially designed communicating equipment in all construction was an integral part in building this engineering feat. The searchlights to the rear are from a flotilla of battleships.

tributed $2,500.00 of telephone plant to the telephone company. How will the telephone company account for this on its books. Under the latest rulings of the F.C.C. this item must appear as a contribution to the company's property in account number 175. The company's right to make any charge for the use of that added property or to earn anything on the contributed amount is seriously questioned.

If the telephone company receivies the investment as a contribution, must it provide the metallic service to its subscribers at the same rate which it previously provided grounded service? If so, is it discriminating between any subscribers who might continue to be served with grounded lines either on the same or neighboring exchange?

● Assuming it is a gift, what will the tax assessor say about the value of the property owned by the telephone company at the next assessment period? When the lines goes down in a storm, is the power company going to replace it? Who is going to provide the money for depreciation and maintenance on the contributed property?

After all, if the power company pays for making your lines metallic, what have you saved? Actually you have only saved the cost of money and while it is a considerable item in itself, on the basis of today's money market it is only one-fourth of the annual charges which the telephone company must meet in maintaining and providing service over metallic circuits.

In other words, unless you increase the rate to the subscriber even though the power company should pay for all of the immediate cost of converting your grounded lines to metallic, the day will come when you will have to replace this wire and have no money with which to do it and in the meantime you will have had to pay taxes and maintain the added plant from year to year.

What about the suggestion of letting the subscriber pay an added rate for two or three years in order to recover the investment and then provide him with metallic service at the former grounded rates? The answer is the same. Such a procdure would be unsound and unfair and, technically, illegal.

● Of course we recognize that there are hundreds of small companies who pay no attention to annual charges, who give no consideration to replacement of their property until it is entirely impossible to render service with it, who keep no books other than to make a record of assessments and collections, and whose rates for service are not subject to regulation or control. In those instances, the power companies should probably pay the cost of the change and the mutual subscriber will not morry about the matters of depreciation and maintenance, but in the cases of the larger companies, where capitalization is important and where the operation of the company has due regard to a reasonable return on its investment, it seems to us that the cost of "metallicizing" the lines or any other capital investment incident to protecting the telephone service from inductive interference should be borne by the telephone company and the annual additional cost reflected in the rate charged for telephone service.

When the Rural Electrification program was first announced and the cost of constructing rural lines in individual cases was submitted to the R.E.A. for approval of grants and loans, no amount was included for cost of reducing the effect of inductive interference upon communication lines. The protest which was received from the telephone companies brought this matter to a head rather quickly and we understand that the R.E.A. Board agreed that the local electric distributing companies could include in their estimates of construction costs, a proper amount to reimburse the tele-

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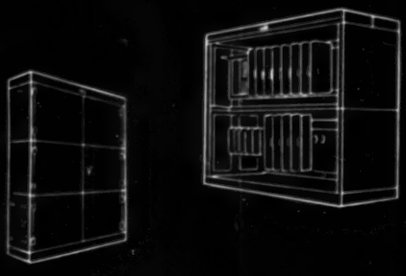

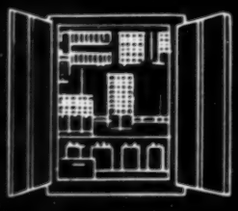

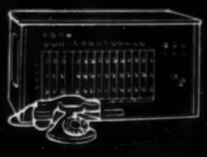

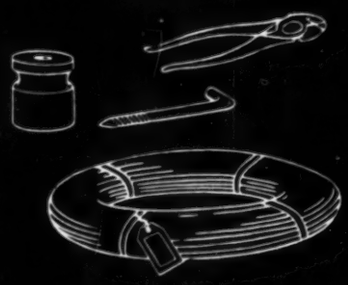

Our complete line of telephonic equipment includes everything needed for construction, operation and maintenance of telephone properties. We call your attention especially to the products listed in the following classifications:

TELEPHONES

Magneto and central battery, manual and automatic, Monophones and conventional styles. Noted for their handsome, modern appearance and rugged, durable construction.

C-A-X's

Self-contained, self-operating units for the small exchange—switch or relay type, for central battery or magneto operation, in capacities of 10 lines and up.

PRIVATE EXCHANGES

Manual and automatic, attended and unattended, with trunk connections to either automatic or manual central offices.

SUPPLIES

A complete range of construction materials, tools, supplies and every needed accessory for telephone exchange construction, operation and maintenance.

AUTOMATIC ELECTRIC

TELEPHONE, COMMUNICATION AND SIGNALING PRODUCTS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 W. Van Buren St., Chicago

Telephones

The Type 35A5 wall-mounting Monophone. This new compact wall model combines the utmost in beauty and convenience.

The Type 34A3 self-contained desk Monophone, which away entirely with the unsightly and inconvenient bel

CENTRAL BATTERY MONOPHONES

Foremost in modern telephone design are the two latest Monophone models shown above—the Type 35A5 wall-mounting Monophone and the Type 34A3 self-contained desk Monophone. Using no bell box, these sets combine to a high degree the maximum of convenience with handsome, modern styling. Available for either manual or automatic operation, and obtainable in a variety of pleasing art shades, with chromium or gold-plated trim. All models are equipped with the remarkable improved "all-positions" transmitter.

Magneto Wall Monophone (Steel box-2-bar generator. Wood box-3 or 5-bar generator).

MAGNETO MONOPHONES

Designed especially for magneto service, the local battery Monophones shown at the left incorporate in their construction the same graceful, modern lines, the same compactness, the same high efficiency of operation that distinguish the central battery models. Also available for magneto operation are a variety of other models for every type of application.

Self-contained Magneto desk Monophone

Other Monophone and conventional style telephones can be furnished, embracing types for every use, for indoor or outdoor application and for manual central battery, automatic central battery or magneto operation. Write for our complete catalog of telephones and telephone parts—free upon request.

AUTOMATIC ELECTRIC

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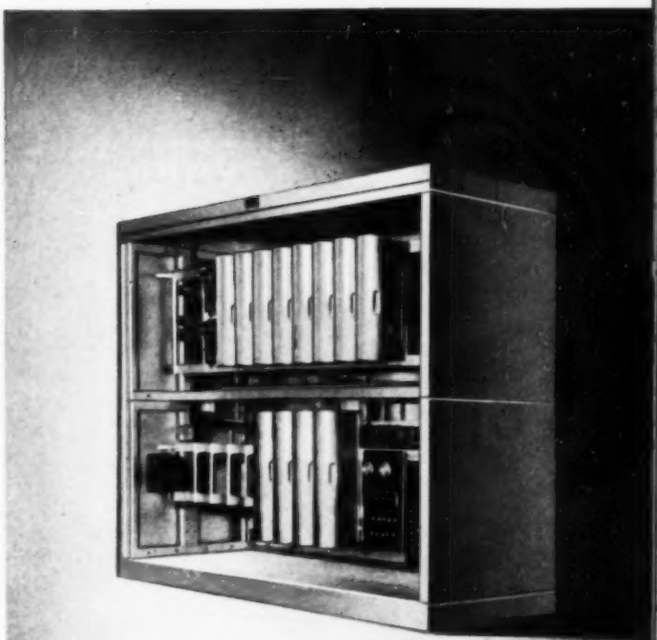
Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 W. Van Buren St., Chicago

C-A-X's

Instant, accurate operation, complete reliability under all sorts of conditions and long, trouble-free life have made the Community Automatic Exchange the most widely used small automatic switchboard in the world today. It effects appreciable economies in small exchange operation, by doing away with the main item of expense—namely, operating labor. Furnished in either switch or relay types, as desired, in graded capacities for every size of small exchange, and either fully equipped or partially equipped to provide for growth.



SWITCH TYPE C-A-X's

At the right (upper view) is shown a typical Automatic Electric switch type C-A-X. Furnished enclosed in all-metal cabinets, these units are available for operation with local or central battery telephones, and for grounded or metallic lines. Self-contained and self-operating, they require only the most modest quarters, such as the back room in a store or home.

POLE MOUNTING C-A-X's

Pole-mounting C-A-X's, installed out-of-doors on ordinary telephone poles, frequently offer economies over conventional types in both operation and first cost. In small sizes, such as the 9-line unit shown here, they are very effective for promoting increased telephone usage in under-developed localities. When a larger exchange becomes necessary at such a point, the pole-mounting unit is easily moved to another similar area.

Send us full details regarding your small exchange situation, and we will make recommendations as to the C-A-X equipment most suited to your needs.

AUTOMATIC ELECTRIC

TELEPHONE, COMMUNICATION AND SIGNALING PRODUCTS

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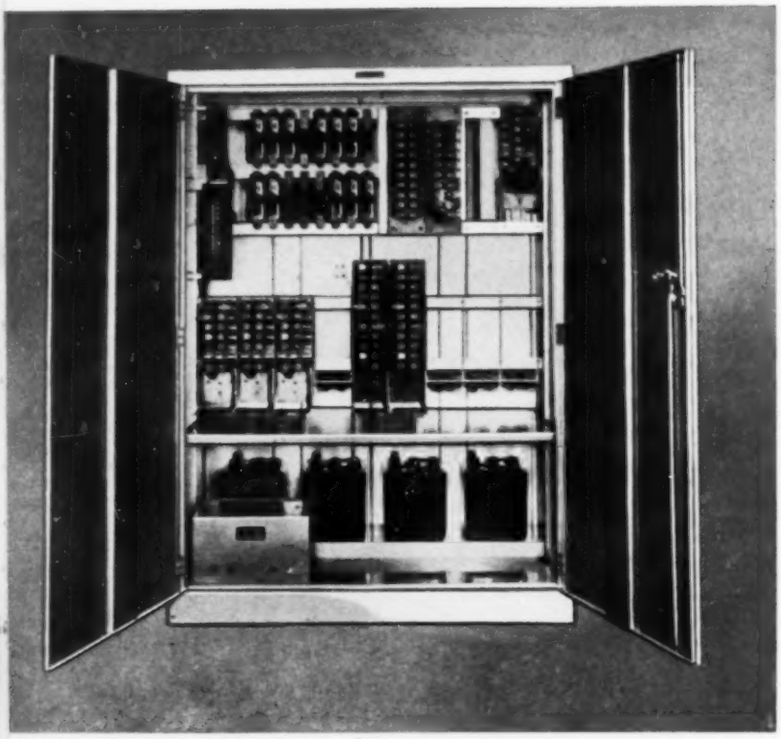
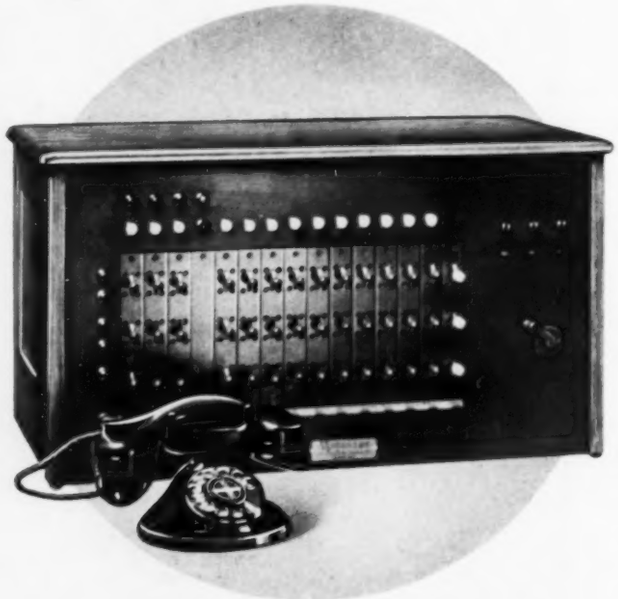
Private Exchanges



The Automatic Electric Type 33A6 P-A-B-X. Capacity —20 local lines and 5 central office trunks. For use with or without attendant's cabinet.

P-A-B-X's

Automatic Electric P-A-B-X's (Private Automatic Branch Exchanges) are designed to provide business organizations, down to the smallest office, with speedy, accurate, *automatic* intercommunication — with improved in-and-out trunk facilities to the central office. This service can be provided either on an attended or unattended basis, as desired. In either case, it represents a definite advance in the private exchange service telephone companies can offer their business users. The larger sizes can be equipped with additional special features, such as executive priority, conference service, code calls, watchman's service, etc. Send for complete information.



This Monotype Cordless P.B.X. is furnished in a 10-line and 16-line model, each with 5 connecting circuits and an ultimate of 4 trunk circuits.

MONOTYPE P-B-X's

For the user who prefers manual service, Monotype P.B.X. boards of either the floor or cordless type, will be found highly satisfactory. All the latest features of operation are included in their design, and workmanship and manufacture are of the highest quality. Their extra strength construction insures a long useful life and makes them a highly satisfactory investment for any telephone company. Full information furnished upon request.

AUTOMATIC ELECTRIC

TELEPHONE, COMMUNICATION AND SIGNALING PRODUCTS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 W. Van Buren St., Chicago
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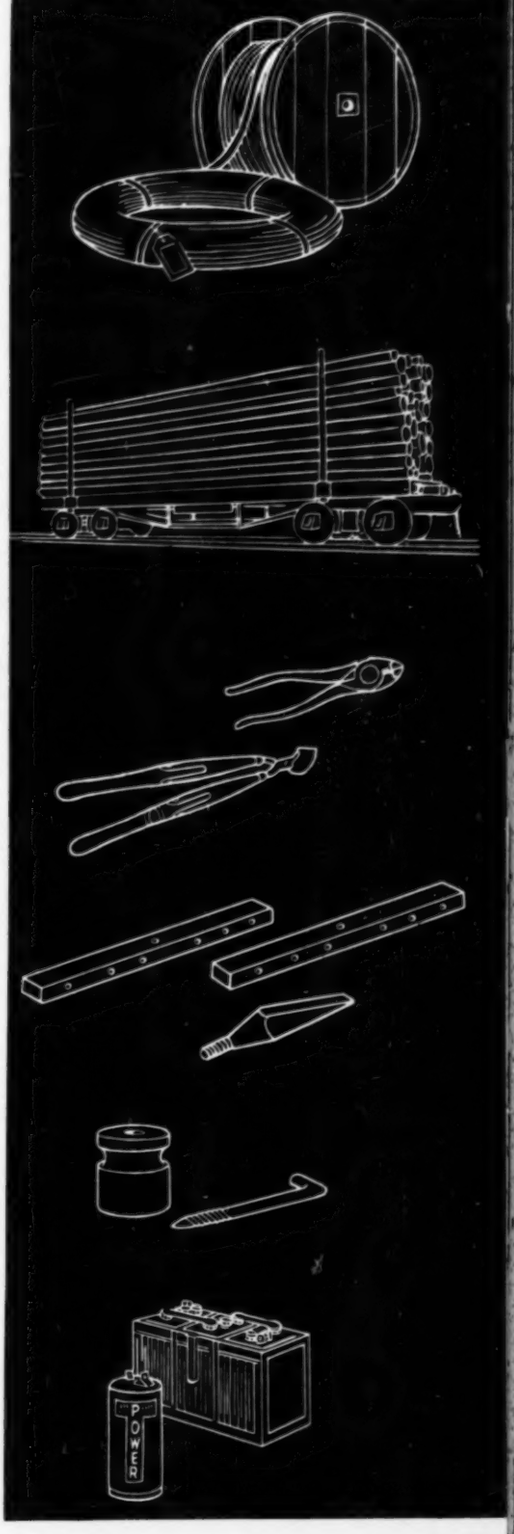
A COMPLETE *Telephone* SUPPLY SERVICE



WIRES AND CABLES

We can supply all requirements for line wire, drop wire, lead covered cable, switchboard cable, etc. Included are such outstanding products as "Copperweld" drop wire, General Cable Company's "Standard Underground" cable and American Steel & Wire Company's Perfected Process line wire.

POLES

Pine and cedar poles, selected for uniformity and lasting qualities. Processed with the latest approved types of treatment.

CONSTRUCTION TOOLS

Well-known brands of construction tools of every type and for every purpose, including "Klein" pliers, belts and climbers, "Plumb" hammers, "Clyde" tree pruners, etc.

CROSS ARMS AND BRACKETS

Douglas firm and yellow pine cross arms in all types and sizes, wood pins and pole steps, oak brackets, etc.

POLE LINE HARDWARE

Telephone hardware of the highest quality, including the well-known "Oliver" brand of pole line materials.

TELEPHONE BATTERIES

Dry cells of recognized manufacturers, designed especially for telephone use. Also storage batteries for every size of installation.

We are also prepared to supply on short notice not only the above-listed items, but also a complete range of every type of product and material required in constructing, operating and maintaining the modern telephone exchange.

AMERICAN AUTOMATIC ELECTRIC SALES COMPANY

WAREHOUSES AT CHICAGO, KANSAS CITY, RICHMOND AND SAN FRANCISCO

1033 West Van Buren Street . . . . . Chicago

Export Distributors:

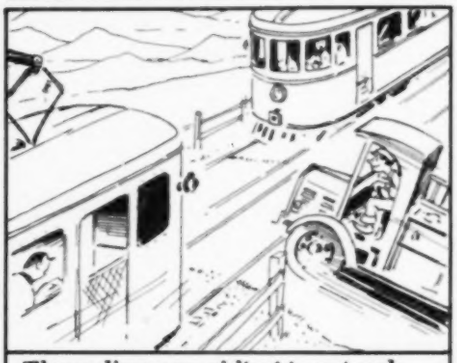
AUTOMATIC ELECTRIC SALES COMPANY, LTD., Chicago

"It's just a tiny scratch", said Jane,
"It doesn't need protection;"
But now she is in dreadful pain
From serious infection.

"A stairway is no place for speed.
Be careful while descending,"
Quoth Dick--for rushing, yes indeed!
A month in bed I'm spending."

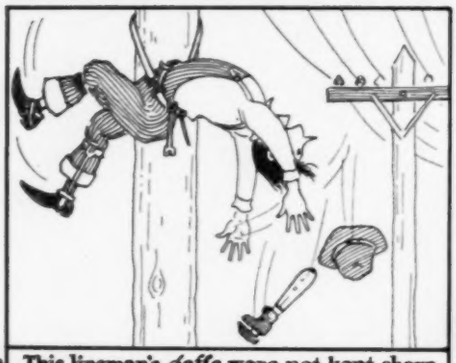
Without his goggles, Oscar drilled
Into a concrete wall,
But particles his eyes soon filled;
He'll work again, next fall.

Although it is the proper thing
When trimming off a tree,
Sam did not use his safety sling
And down he fell -- Ah! Me!



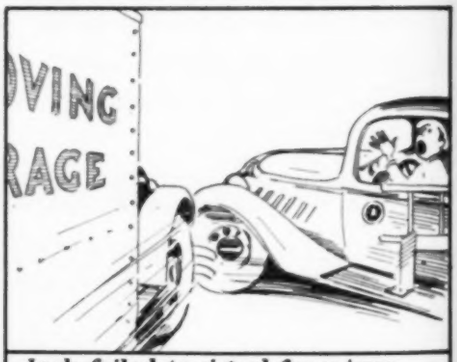
Three linemen riding in a truck
Are nursing bumps and sprains
Because the driver tried to duck
Between two passing trains.

Relying too much on his back
While lifting up a box,
Joe strained his sacro-iliac
And still is on the rocks.



This lineman's gaffs were not kept sharp,
Perhaps he was too lazy;
He almost got his golden harp--
His mem'ry still is hazy.

To catch a train Nell made a dash,
Ne'er looked to left nor right;
A passing motor car--a crash!
Nell won't be home tonight.



Jack failed to signal for a turn,
A truck came with a roar;
A placard reading DON'T DISTURB
Now hangs upon Jack's door.

From standing under men at work
John's life hangs by a thread;
A hammer falling with a jerk
Struck Johnnie on the head.

For reaching out to do a chore
Frank Take-a-chance is sadder.
He'll never do it any more,
Instead -- he'll move the ladder.

A manhole is a sheltered spot
If properly protected;
But here's a man who just forgot,
And -- does he look dejected?

By G. HAMILTON

An up-to-date farm where good telephone service is a necessity.

Routine Inspection of Rural Lines

Rural lines present many problems. This article discussing Routine repairs, Leakage, and Tree interference is indeed timely and a suggestion to companies endeavoring to keep their equipment and service of the best.

ROUTINE Inspection of rural lines helps to insure uninterrupted service, and tends to keep the entire system running smoothly at all times. Theoretically speaking, rural lines should always be in as good a condition as when first constructed.

In order to do this, deterioration must be kept at a minimum, by applying corrective maintenance. It is of primary importance that all unsatisfactory conditions of lines discovered on routine inspection receive immediate attention, especially those conditions of a hazardous nature that might cause possible damage to property or injury to persons.

● In as much as routine inspection consists of the preparatory work prior to making needed repairs to the line equipment, it may be necessary for the repairman to cover portions of the line on foot in order to locate existing faults.

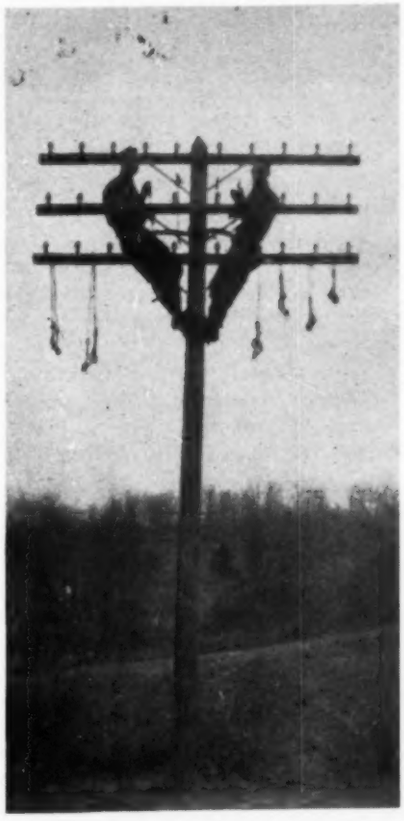
Items usually found on inspection are: tree and brush interference, broken pins, wire lying on cross arms, broken or missing insulators, wire tied directly on pins or coming in contact with pole guy. Broken or loose tie wires, loose transposition brackets, slack lines, leaning, broken, burned or decayed poles. Broken cross arms, and loose pole guys.

It is never economical to delay performing line inspection routines, as this tends to the probable development of transmission losses, noise, cross talk, and etc.

● It must be understood that routine repairing differs from ordinary repairing in that it is a preventive measure, whereas regular repairs is the work done clearing reported trouble.

As the result of making routine inspections, repairs now become necessary in the following manner. (1) Poles found to be broken, rotted or burned off at the ground level are a source of danger which may cause other poles in the line to break during a storm from the lack of sufficient support from the imperfect pole.

If rotted or broken poles are in good condition above the ground, they may be reset or reinforced by setting a stub pole (stub cut from an old pole) placed in the ground and then bound together by means of line wire. If the upper part of the damaged pole is not in a serviceable condition, then it should be replaced by a good pole of the same type.



Linemen cutting slack out of line wire.

Poles located near railroad right of ways are some times destroyed by grass fire. In order to prevent this, the grass should be removed for a distance of 3 or 4 feet around the poles and the poles well banked with sand, gravel or stone before the grass near the poles dries out.

Unauthorized attachments on poles, such as advertisement cards, metal signs, guide boards, and etc., should be removed because of possible danger to workman climbing poles.

● (2) Slack guys weaken the pole lines causing trouble, especially where side guys pass through the line wires, and should be pulled up tight. Anchors lifting on account of soft ground, or being improperly set, will result in the guy becoming slack, and should be reset or a new anchor placed before pulling slack in the pole guy wire. Occasionally it is found that a guy is tied to a cross arm with a piece of wire to clear a case of line trouble. While this may be considered necessary to clear the trouble temporarily it is none the less very bad maintenance practice and should be avoided. The best plan is to make the needed repairs at once and thereby prevent trouble later.

● (3) When a cross arm is found broken, split at the ends, rotted, or the pins loose, it should be replaced. Particular

attention should be given to cross arms on corner poles as they are usually subjected to more strain than poles in a straight line. If the cross arms on corner poles show the slightest evidence of decay they should be replaced immediately.

● (4) Transposition brackets occasionally work loose, due to the nuts and bolts not being securely tightened. This causes the brackets to lean and the top portion may come in contact with a line wire and thus cause trouble. Such brackets should be straightened to a vertical position.

● (5) Slack line wire is frequently responsible for intermittant trouble on rural lines. When the slack exceeds twelve inches to a span it should be pulled up and the slack wire cut out.

Slack wire often develops due to corner poles giving slightly, or from breaks where the wire had not been pulled up properly when repaired. To correct this condition, first untie all corner wires on each side of the corner as far as the slack in the wires exists, then pull the pole back to its original position and make rigid, then when the line wires are retied to the insulators the slack will have disappeared without any wires having been cut.

When cutting slack out of any line wire to be pulled up to alignment with other wires, opening of the circuit may be prevented by equipping a piece of No. 12 B&S gauge insulated flexible copper wire 4 or 5 feet in length with suitable spring type cord clips and connect one clip to each grip of the slack blocks holding the line wire being cut. This will keep the circuit closed while the slack is being cut out and the wire spliced together. All loose, broken, or otherwise damaged line tie wires should be replaced, also missing tie wires.

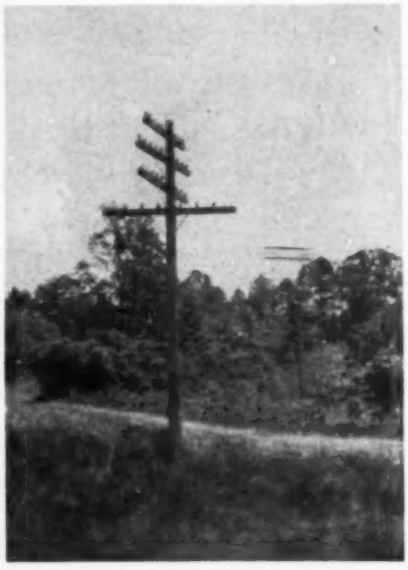
● Leakage between the wires of a rural lead is negligible if the circuits are clear of all objects and supported on good insulators. However, if the insulators are defective it may cause transmission loss during wet weather.

If the insulators are of glass or a thoroughly vitrified porcelain the leakage of current through the material of the insulator rarely occurs unless the insulators are cracked or otherwise damaged. Therefore, when discovered, all defective line wire insulators should be replaced.

Replaced insulators should be screwed down tight on the cross arm pin, or bracket and the line retied to the insulator with a new tie wire. When removed, damaged insulators should never be thrown on the road or nearby fields as they may cause injury to persons or animals. They should be placed in a suitable waste receptacle on the repairman's car for safe disposal.

● Trees are a constant source of interference to the satisfactory operation of rural lines, and preventive action should be taken before the trees actually come in contact with the line wire. In some cases the trees should be purchased and cut down as this eventually may prove cheaper than frequent trimming.

If property owners or state highway commission refuses to permit the trees to be cut down, then they should be properly trimmed, care being taken to avoid mutilation of the tree by correctly shaping the branches. However, effort should always be made to obtain as much clearance for the line as possible. A clearance of four or five feet is desirable if it is certain that it can be accomplished, by allowing for limbs growing



Line through timber with right-of-way cut eliminating tree trimming.

toward the line wires and cutting as far back as possible, without injury to the trees or the property owners feelings. Special attention should be given to over hanging limbs as they drop several feet when loaded with summer foliage or sleet and snow in Winter.

When a limb is removed from a tree the cut on the trunk should be properly treated with suitable paint to prevent decay.

● Vines and underbrush are important items to be considered. Vines grow near and climb poles entwining themselves around the line wires thus causing light grounds in dry weather and more heavy grounds in wet weather, these should be removed.

Property owners usually are glad to get rid of underbrush, and it should be removed before it grows up and becomes trees. However, it is always best to get the permission of the property owner before attempting to remove the brush.

After the brush is cut it should be carefully disposed of by either burning or hauling away.

After completion of work performed in connection with routine inspections and repairs, care should be taken to make sure that unused material or tools are not left lying on the ground or hanging overhead. Also, that no discarded material is left on private property or the highway which might result in complaints from property owners, motorist or pedestrians.

● In conclusion, it may be said that the importance of periodically scheduled routine inspection and repairs of rural telephone lines in their relation to satisfactory telephonic communication service to the public can hardly be underestimated.

Carter Named

E. F. Carter, vice-president, American Telephone & Telegraph Co., has accepted the chairmanship of the Communications Division in the United Hospital Campaign in New York, Edward R. Stettinius, Jr., chairman of the Commerce and Industry Committee has announced.

Service That Saves Lives

A night operator at Yuma, Ariz., recently answered a line signal from the plant of a local power company and connected the calling party with a Yuma doctor. Shortly after she had disconnected, the doctor called back asking where the call had come from as an injured man in need of immediate attention had neglected to say where he was. The operator told the doctor where the call originated, a service that was vital to life, as the doctor later explained the injured man had been caught in a machinery belt and was bleeding profusely when he arrived.

Gray Pay Station vs. Western Electric

Suit instituted against Western Electric by the Gray Telephone Pay Station Co., Hartford, Conn., will be heard in Chicago on February 10th. According to George A. Long, president of the Gray Company and plaintiff in the suit, other suits are being prepared against companies purchasing pay stations which Western Electric is now making and claimed as an infringement. Plaintiffs will depend on the court to obtain the necessary information as to those companies, providing of course, that Gray Company is successful. In two previous suits against the same company for infringements, the plaintiffs have been successful.

STURGIS
Posture Chairs
for
Telephone Operators

- REDUCE FATIGUE
- INCREASE EFFICIENCY
- PROMOTE MENTAL ALERTNESS
- IMPROVE HEALTH

Distributed by

Stromberg-Carlson Telephone Mfg. Company

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A Demonstration Will Tell You More

STURGIS TELEPHONE OPERATOR CHAIR

EASILY AND QUICKLY ADJUSTABLE BY HAND

No. 826-A

Another new chair with heartshaped seat (16½" wide, 14½" deep) and form fitting back (6x14"). Upholstered in genuine leather or linen frieze fabric over rubberized curled hair cushions which add a new comfort to posture chairs. **Back support and seat height easily and quickly adjusted by hand.** Seat height 17 to 21 inches, by revolving seat. Base of 1" tubing—all joints welded. Tubular guard covers threaded spindle. Hard rubber casters—1⅝" diameter. Name plate on back of back.

No. 426-C

For those who wish an air-i-a-ted seat (12x16"), this chair is provided with a 5-ply saddle, perforated seat—finished in clear lacquer. It has all the desirable features of a cane seat, yet will never sag or become uncomfortable—hence is far superior. The back (5x14") is upholstered in genuine leather over curled hair. Regularly equipped with a single post back assembly, however, also available with a double support back assembly at the same price when symbol "DS" is specified. (Example—No. 425-DS). **Back support and seat height easily and quickly adjusted by hand.** Seat height 17 to 21", 22 to 26", 28 to 32", by revolving seat. Base of 1" tubing—all joints welded. Foot rest of straight sections to encourage correct posture. Regularly furnished with nickle plated cushion glides but available with casters when specified. Name plate on back of back.

No. 950-B
Spring Back Chair

A spring back posture chair, h shaped seat "B" (16½" wide, 1 deep) and form fitting back (6x14" holstered in genuine leather, or frieze fabric over curled hair pads. available in "A" type seat but not "C" seat. Back completely and in taneously adjustable by hand as to sition and spring tension. Seat h adjustable from 18 to 23". Base of tubing—all joints welded. Hard r casters—1⅝" diameter. Name plat back of back.

("C" type seat not available on this c

SEAT, BACK AND BASE COMBINATIONS

Three types of seats are available:

"A"—A thick rubberized curled hair pad upholstered in genuine leather or fabric. More resilient than springs, this seat is the last word in comfort.

"B"—Curled hair pads, comfortably shaped, upholstered in genuine leather or fabric. A less expensive seat than type "A".

"C"—A 5-ply birch, saddle type seat, perforated to provide proper air-i-a-tion. More comfortable and lasting than a cane seat. (See No. 426-C).

(Example: No. 826-A, No. 826-B, No. 826-C)

CORRECT POS

There is nothing we do so much and yet so ba as sitting.

A person sitting correctly and erectly cannot b but express alertness, self reliance, energy, poise power.

STURGIS Posture Chairs are designed to ind correct sitting posture without any effort on the p of the occupant.

Correct Posture is always associated with v and energy. It cannot be otherwise, for executi everywhere know there is a definite relation betw

correct sitt
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• Neat, Up-To-Date, Well Made •

Distributed by Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

Reduce Fatigue, Increase Efficiency

A Model For Every Need

No. 446-B

This chair is equipped with a roomy seat (16½" wide, 14½" deep) and a form fitting back upholstered in either genuine leather or linen frieze fabric, over curled hair pads. **Back support and seat height easily and quickly adjusted by hand.** Seat height 17 to 21" 22 to 26", 28 to 32", by revolving seat. Foot rest of straight sections to encourage correct posture. Base of 1" tubing—all joints welded. Tubular guard covers threaded spindle. Regularly furnished with nickle plated glides, however, also available with casters when specified Name plate on back of back.

No. 975-A

Spring Back Chair

A Telephone Operator Chair equipped with a spring back. Heart shaped seat "A" (16½" wide, 14½" deep) and form fitting back (6x14") upholstered in genuine leather over rubberized curled hair cushions—resilient and comfortable. Also available in "B" type seat but not type "C" seat. Back completely and instantaneously adjustable by hand as to position and spring tension. Seat height 24" to 28". Base of 1" tubing equipped with new rubber cushioned sliding foot rest (9x12"). Regularly furnished with nickle plated cushion glides but available with casters when specified. Name plate on back of back. **("C" type seat not available on this chair)**

POSTURE

correct sitting habits, increased efficiency and better health.

Poor posture hampers the proper functioning of the vital organs and results in fatigue.

Fatigue is a natural result of work and shows itself in a diminished capacity for doing work. **Fatigue is also a matter of dollar and cents**—for it actually affects output just as much as it affects the worker. And fatigue is the greatest single obstacle to maximum efficiency.

Sturgis Posture Chairs will reduce fatigue,—increase efficiency.

IMPORTANT

Casters: Size 1⅝" diameter—Hard rubber.

Glides: Size 1⅛" diameter. Nickle plated. Rubber cushioned.

Slip Covers: Available at slight extra cost on any seat and back when specified.

Enamels: Choice of olive green, brown, maroon or black enamels.

Leathers: Choice of brown, green, blue, maroon, red or black genuine leather.

Fabrics: Choice of brown, green or maroon, linen frieze fabric in place of genuine leather.

Sliding Foot-Rest: When specified, any of the higher chairs available with sliding foot-rest like that shown on No. 975-A at slight extra cost.

• • • Ask For Demonstration • • •

Distributed by Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BANISH FATIGUE -- IT PAYS

Sturgis Announces —

A SUPERVISOR'S POSTURE CHAIR

No. 406-B

HERE IS SOMETHING NEW!

A true Posture Chair designed exclusively for the supervisor.

Seat size 16½" wide, 14½" deep. Back size, 6x14", formfitting. Equipped with N. P. rubber cushioned, silent glides.

Also available with an "A" type seat (see inside description) which means thick, rubberized curled hair seat and back pads. More resilient than springs, these pads add a new comfort to Posture Chairs.

Back support easily and quickly adjustable by hand.

A tablet arm on right of seat for convenience. A padded armrest on left of seat for comfort.

Upholstered in either genuine leather or linen frieze fabric.

Foot-rest with rubber tread integral part of chair.

Seat height adjustable by revolving—36 to 40 inches.

Distributed By Stromberg-Carlson Telephone Mfg. Company
Rochester, New York

Manufactured By
Sturgis Posture Chair Co.
Sturgis, Mich.

We'll Specify Stromberg-Carlson Supplies again. Then We'll be sure of Quality and Service.
Stromberg-Carlson
TELEPHONE CONSTRUCTION MATERIAL AND SUPPLIES

For SERVICE and ECONOMY *Specify* Stromberg-Carlson SUPPLIES

•

Quality, economy and service are assured when Stromberg-Carlson materials are specified. The first two are synonymous, for unless construction materials of dependable quality are chosen, costly replacements will soon be necessary. Good construction materials are far more economical . . . even a slightly longer life more than offsets the small additional cost.

In the Stromberg-Carlson line of construction materials will be found every item the operating company requires, each one of a high quality that is representative of Stromberg-Carlson.

Stromberg-Carlson's prices are as low as can be found anywhere for dependable materials. Service is prompt.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY
FACTORY AND GENERAL OFFICES: 100 CARLSON ROAD, ROCHESTER, N. Y., U. S. A.
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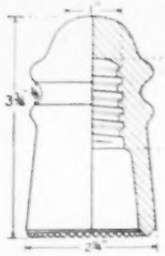
Stromberg-Carlson

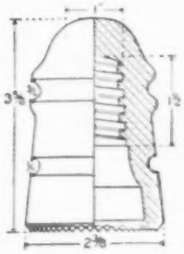
No. 9 Hemingray Glass Insulators



Pony

Height Over All	inches	3¾
Diameter Over All	inches	2¼
Diameter Groove	inches	⅜
Weight Each	pounds	7/16
Quantity per Box		250
Approx. Wt. per Box	pounds	162

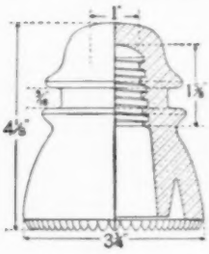
No. 12 Hemingray Glass Insulators



Double Groove, Pony

Height Over All	inches	3⅝
Diameter Over All	inches	2⅜
Diameter Top Groove	inches	⅜
Weight Each	pounds	⅝
Quantity per Box		250
Approx. Wt. per Box	pounds	188

No. 42 Hemingray Glass Insulators



Double Petticoat

Height Over All	inches	4⅛
Diameter Over All	inches	3¾
Weight Each	ounces	24
Quantity per Box		100
Approx. Wt. per Box	pounds	169
Leakage Distance	inches	6½
Wet Arcing Distance	inches	1¼

Crapo Double Galvanized Telephone and Telegraph Wire

Crapo Galvanized Telephone and Telegraph Wire is drawn from steel of special analysis and double galvanized by the Crapo Patented Process. Every step in manufacture is safeguarded by laboratory supervision to make certain that each grade and size conforms to predetermined standards. This exactitude in manufacture insures wire which meets every requirement for electrical conductivity, tensile strength, ductility, and durability.

The Crapo Galvanizing Process applies to Crapo Galvanized Wire, a heavy, uniform zinc coating which offers maximum resistance to corrosion. This protective coating is so adherent and so ductile that the wire can be wrapped around its own diameter and subjected to sharp twists or bends without the galvanizing, cracking, flaking, or peeling.

Crapo Galvanized Telephone and Telegraph Wire is guaranteed to conform to all standard specifications.

Extra Best Best (E.B.B.) is highest in electrical conductivity with a range of electrical resistance of 4700 to 5000 mile ohms.

Best Best (B.B.) combines slightly higher resistance with greater tensile strength than E.B.B. Maximum average electrical resistance, 5600 mile ohms.

Steel Grade is designed for short line service where electrical resistance can be sacrificed for tensile strength. Maximum average resistance, 6500 mile ohms.

HTL-85—New High Tensile Strength Low Resistance Crapo Wire.

Cedar Telephone Poles

For a number of years the Stromberg-Carlson Telephone Manufacturing Company has supplied Page & Hill Cedar poles to its telephone clients.

Page & Hill Co. have been producers of Cedar poles for over thirty-five years, cutting their own poles in the woods and operating their own concentrating yards and butt-treating plants. Supplied from large stocks maintained at producing yards in Northern Minnesota, Wisconsin and Michigan, and from a strategically located concentrating yard in Minnesota where both Northern White Cedar and Western Red Cedar poles are kept in stock at all times.

Everstick Expanding Anchors

Ease of installation, ease of expansion, maximum power and long life are the result of years of experience and improvements in these anchors.

The exclusive Everstick guides hold the plates in perfect alignment during expansion of the anchor.

Anchors are made of certified malleable iron.

Expanded

3-Way Anchors

An ideal guy anchor for all around use. Built to hold strains 100 per cent greater than rated holding power for ordinary soils.

A 6 and 10-inch anchor can be furnished proportionately designed for minimum and maximum strain requirements.

Wood Brackets

These brackets are fastened to pole or wall by spikes.

Holes in brackets are ⅝-inch diameter.

Brackets are securely wired in bundles of 20 or 25 each.

Cat. No.	Size Inches	Std. Pkg.	Wt. Lbs. per 1000
J2550-4	1½x2 x10	250	600
J2551-1	1½x2 x12	250	800
J2552-3	1½x2¼x12	250	825
J2553-L.D.	1⅝x2 x12	250	800
J2554-2	2 x2¼x12	250	925
J2555-W.U.	2 x2⅜x12	250	1000
J2557-W.U.*	2 x2¾x12	250	1150

*New.

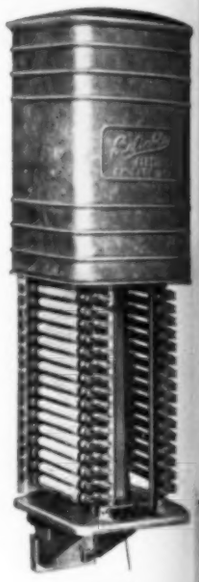
Wood Pins

Made of locust wood. Is hard, close-grained wood, impenetrable to moisture and practically impervious to decay. Especially well suited for making wood insulator pins where accurate turning and freedom from shrinking or warping are primary considerations.

All pins are shipped in heavy burlap bags.

Cat. No.	Size Pin Inches	Size Top Inches	No. In Std. Pkg.	Wt. per 1000 in Pounds
1760	1¼x8	1	250	325
1761	1½x9	1	250	480

Reliable Pole Cable Terminals



B-27

The latest, modern, all protected cable terminal with tight cable chamber, having tachable mounting bracket for installation at pole.

Drop wiring is done on side from pole, giving perfect visi and convenience and allowing minal to be mounted very c pole.

Individual clips for carbon fuses prevent carbons from ing when removing fuses. Un sary to remove fuses when ing jumper wires. All binding brass, treated, mounted in grade of bakelite, cannot sho turn around.

Rosin Core Solder

Ribbon flat type lb. spool sizes from proximately ¼-inch Tested before Stock sizes, Has punched Contains pounds. tic rosin that will corrode.

Wire Holder

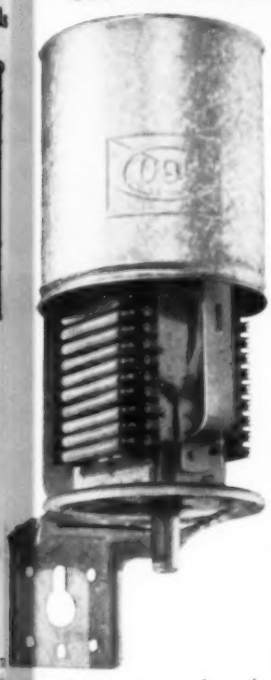
Double Groove

For use as a bracket where from the pole to the building angle, and as a ard house bracket carrying the a straight run the building, or for deadening metal exposed after installation unaffected by atmospheric tions and will not make rust on the house.

No. **1622** with ⅝x¾ inch bakelite. The Weight per 100, 25 lbs.

Stromberg-Carlson

Cook S-6 Protected Terminals



Strength, light weight, rigidity and perfect insulation are combined in this terminal.

Bracket, base, cable box (except zinc front), cover spring, mounting panels, as well as hood, are all formed from Toncan iron, a metal of high resistance to corrosion. All parts fit perfectly and are thoroughly galvanized.

Hollow studs for cable wires, and springs for holding fuses, lightning arresters and connecting jumpers, are all set in hard rubber, providing perfect insulation.

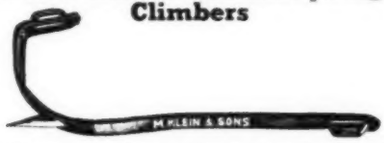
Cable box has a removable zinc cover, fastened in place with machine screws and made air-tight by a rubber gasket. After cable wires are connected and cable soldered to nozzle, it is good practice to fill the top of the nozzle around the cable wires and flood the floor with a thin layer of compound.

Treated waterproof fiber is used to protect jumper wires where they pass through steel base and side panels.

Fuse holders are made under Cook patented design, and keep fuse under permanent tension. They permit fuse to be easily installed and removed, yet hold it securely. Lightning arresters are held under permanent tension by a separate spring. These springs being of phosphor bronze, will last indefinitely.

Cable connections are made through hollow brass studs, set in hard rubber, which pass through sides of box. The outside ends of these studs are concave, and have sufficient solder to permit copper wire to be permanently fastened by the touch of a hot soldering iron. Cable connections being made on outside of box can easily be inspected. On the jumper side, both screw and washer, and soldered connections, are provided for.

No. 1901 Klein's Standard Weight Climbers



When ordering specify length of shank desired. Measure from instep to extreme end. Other than stock sizes to order. Tested before leaving factory.

Stock sizes, 15, 15½, 16, 16½, 17, 17½ and 18 inches.

Has punched strap loops. Packed 1 pair in a carton. Weight, 3¾ pounds.

No. 1903 Klein's Lightweight Climbers

Lightweight pattern with riveted strap loops. Packed 1 pair in a carton. Weight, 2⅞ pounds.

No. B-7 Cook Lightning Arresters

For protection against lightning entering cable from subscribers' drops or open leads.

Capacity, 10 wires.

Back and base is of a single piece of heavy steel, hot galvanized. Insulation and fanning strip is of a single piece of moulded bakelite. The contact springs are of phosphor bronze.

Rubber Insulated Telephone Wires

Manufactured by

Habirshaw Cable & Wire Corporation

For Sale Exclusively Through

Stromberg-Carlson Telephone Mfg. Co.

Habirshaw "Ecco" Brand Telephone Wires are manufactured to meet the following requirements—as "drops" extending a telephone circuit from open wire leads or distributing cable terminals to the subscriber; in bridling open wire lines; for ring wiring, to be used inside of buildings for extending telephone circuits from arresters, or other terminating fixtures of outside lines; for extending telephone circuits on distributing frames; for terminating telephone cables, extending the conductor of the cable through a pothead to some type of distributing panel, etc.

Conductors are all of high tensile strength with high conductivity.

Each conductor is insulated with a rubber compound of strong mechanical and high electrical characteristics, and (containing anti-oxidants) is designed to resist oxidation. It embodies the latest discoveries in the art of making rubber compounds for insulating purposes.

All wires for outside application have a protective covering to prolong the life of an already long-life rubber insulation, a closely woven cotton braid of highest quality, double-ply, cotton yarn. This braid is impregnated with an asphalt saturator that penetrates every fibre of the cotton. It is finished with a special, high melting point pitch to seal out all moisture and air. Each coil carefully tested and inspected.

No. 17 A.W.G. (B & S) Bronze Twisted Pair Outside Distributing Wires—100 Megohm Grade.

Consists of two separately insulated tinned bronze conductors, each covered with a weatherproof braid and twisted together into what is termed a twisted pair.

No. 17 A.W.G. (B & S) Bronze Parallel Outside Distributing Wire—100 Megohm Grade.

Consists of two separately insulated tinned bronze conductors laid parallel and covered with a single weatherproof cotton braid.

No. 16, 18, and 19 A.W.G. (B & S) One, Two, and Three-Conductor Bridle Wire—100 Megohm Grade.

Consists of one, two, or three tinned copper conductors, separately insulated and covered with weatherproofed cotton braids. The two and three-conductor types have the conductors twisted together.

No. 18, 19, and 22 A.W.G. (B & S) One, Two, and Three-Conductor Inside Telephone Wire—100 Megohm Grade.

Consists of one, two, or three insulated, tinned copper conductors, individually covered with braids of glazed cotton yarn. The two and three-conductor types have the conductors twisted together.

No. 20 and 22 A.W.G. (B & S) One, Two, and Three-Conductor Flameproof Jumper Wire—100 Megohm Grade.

Consists of one, two, or three insulated, tinned copper conductors, individually covered with braids of flameproofed cotton yarn. The two and three-conductor types have the conductors twisted together.

No. 18, 19, 20, and 22 A.W.G. (B & S) Two-Conductor Pothead Wire — 100 Megohm Grade.

Consists of two insulated tinned copper conductors, twisted together without outside coverings.

Type O Cook Sub-Station Protectors

A weather-proof and fire-proof protector that may be mounted indoors or outdoors.

Base and back is a single piece of heavy white glazed porcelain, so made that surface leakage is eliminated. The hood fits tight to the sides and bottom of the porcelain, the galvanized bracket acts as a stop. The hood, of Everdur, is grounded through a guide at the top of the arrester.

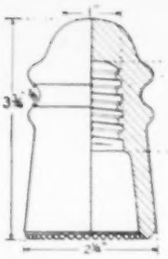
Phosphor bronze fuse clips are securely fastened to the porcelain by oval head brass screws. Fuses are 5-ampere capacity.

Lightning arresters are ground on a copper ground strop. Furnished with True Gap Dischargers that will not permanently ground the line.

Line and instrument wires are connected on opposite sides of the porcelain. Line wires are drawn through holes in the porcelain base and terminate on the face of the porcelain under hexagon brass nuts. Instrument and ground wires enter through holes in the base and are taken up back of the porcelain to binding posts.

Stromberg-Carlson

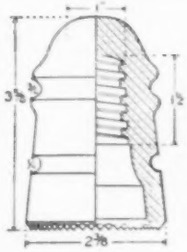
No. 9 Hemingray Glass Insulators



Pony

Height Over All	inches	3¾
Diameter Over All	inches	2¼
Diameter Groove	inches	⅝
Weight Each	pounds	⅛
Quantity per Box		250
Approx. Wt. per Box	pounds	162

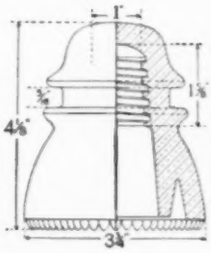
No. 12 Hemingray Glass Insulators



Double Groove, Pony

Height Over All	inches	3⅝
Diameter Over All	inches	2⅜
Diameter Top Groove	inches	⅜
Weight Each	pounds	⅛
Quantity per Box		250
Approx. Wt. per Box	pounds	188

No. 42 Hemingray Glass Insulators



Double Petticoat

Height Over All	inches	4⅛
Diameter Over All	inches	3¾
Weight Each	ounces	24
Quantity per Box		100
Approx. Wt. per Box	pounds	169
Leakage Distance	inches	6½
Wet Arcing Distance	inches	1¼

Crapo Double Galvanized Telephone and Telegraph Wire

Crapo Galvanized Telephone and Telegraph Wire is drawn from steel of special analysis and double galvanized by the Crapo Patented Process. Every step in manufacture is safeguarded by laboratory supervision to make certain that each grade and size conforms to predetermined standards. This exactitude in manufacture insures wire which meets every requirement for electrical conductivity, tensile strength, ductility, and durability.

The Crapo Galvanizing Process applies to Crapo Galvanized Wire, a heavy, uniform zinc coating which offers maximum resistance to corrosion. This protective coating is so adherent and so ductile that the wire can be wrapped around its own diameter and subjected to sharp twists or bends without the galvanizing, cracking, flaking, or peeling.

Crapo Galvanized Telephone and Telegraph Wire is guaranteed to conform to all standard specifications.

Extra Best Best (E.B.B.) is highest in electrical conductivity with a range of electrical resistance of 4700 to 5000 mile ohms.

Best Best (B.B.) combines slightly higher resistance with greater tensile strength than E.B.B. Maximum average electrical resistance, 5600 mile ohms.

Steel Grade is designed for short line service where electrical resistance can be sacrificed for tensile strength. Maximum average resistance, 6500 mile ohms.

HTL-85—New High Tensile Strength Low Resistance Crapo Wire.

Cedar Telephone Poles

For a number of years the Stromberg-Carlson Telephone Manufacturing Company has supplied Page & Hill Cedar poles to its telephone clients.

Page & Hill Co. have been producers of Cedar poles for over thirty-five years, cutting their own poles in the woods and operating their own concentrating yards and butt-treating plants. Supplied from large stocks maintained at producing yards in Northern Minnesota, Wisconsin and Michigan, and from a strategically located concentrating yard in Minnesota where both Northern White Cedar and Western Red Cedar poles are kept in stock at all times.

Everstick Expanding Anchors

Ease of installation, ease of expansion, maximum power and long life are the result of years of experience and improvements in these anchors.

The exclusive Everstick guides hold the plates in perfect alignment during expansion of the anchor.

Anchors are made of certified malleable iron.

Expanded

3-Way Anchors

An ideal guy anchor for all around use. Built to hold strains 100 per cent greater than rated holding power for ordinary soils.

A 6 and 10-inch anchor can be furnished proportionately designed for minimum and maximum strain requirements.

Wood Brackets

These brackets are fastened to pole or wall by spikes.

Holes in brackets are $\frac{5}{16}$-inch diameter.

Brackets are securely wired in bundles of 20 or 25 each.

Cat. No.	Size Inches	Std. Pkg.	Wt. Lbs. per 1000
J2550-4	1½x2 x10	250	600
J2551-1	1½x2 x12	250	800
J2552-3	1½x2¼x12	250	825
J2553-L.D.	1⅝x2 x12	250	800
J2554-2	2 x2¼x12	250	925
J2555-W.U.	2 x2⅜x12	250	1000
J2557-W.U.*	2 x2¾x12	250	1150

*New.

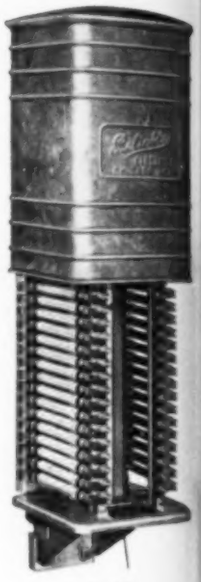
Wood Pins

Made of locust wood. Is hard, close-grained wood, impenetrable to moisture and practically impervious to decay. Especially well suited for making wood insulator pins where accurate turning and freedom from shrinking or warping are primary considerations.

All pins are shipped in heavy burlap bags.

Cat. No.	Size Pin Inches	Size Top Inches	No. In Std. Pkg.	Wt. per 1000 in Pounds
1760	1¼x8	1	250	325
1761	1½x9	1	250	480

Reliable Pole Cable Terminals



B-27

The latest, modern, all
protected cable terminal wit
tight cable chamber, having
tachable mounting bracket fo
installation at pole.

Drop wiring is done on side
from pole, giving perfect visi
and convenience and allowing
minal to be mounted very cl
pole.

Individual clips for carbon
fuses prevent carbons from
ing when removing fuses. Un
sary to remove fuses when
ing jumper wires. All binding
brass, treated, mounted in
grade of bakelite, cannot sh
turn around.

Rosin Core Solder

Ribb
flat typ
lb. spo
sizes fro
proxim
¼-inch
about
inch dia
Contain
tic ros
that wi
corrode.

Wire Hold

Double Gro

For use as a
bracket where th
from the pole
to the building
angle, and as a
ard house bracke
carrying the pa
a straight run
the building, or for deadenin
metal exposed after installati
unaffected by atmospheric
tions and will not make rust
on the house.

No. **1622** with $\frac{5}{16}$x¾ inch
Weight per 100, 25 lbs.

Coo

Fuse hold
keep fuse un
easily install
arresters are
These spring
Cable con
set in hard
outside ends
solder to pe
the touch of
made on outs
er side, both
are provided

No. 1

When ord
from instep
Tested befor
Stock size
Has punch
3¾ pounds.

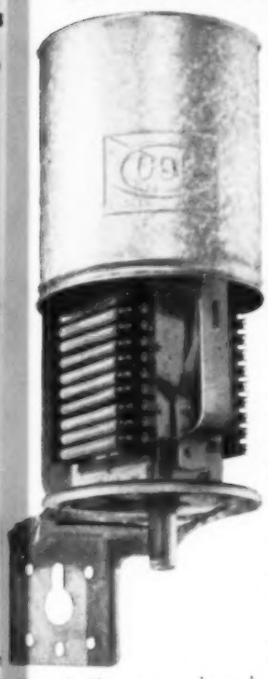
No. 1903

Lightweig
pair in a car

No.

Stromberg-Carlson S

Cook S-6 Protected Terminals



Strength, light weight, rigidity and perfect insulation are combined in this terminal.

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Cable box has a removable zinc cover, fastened in place with machine screws and made air-tight by a rubber gasket. After cable wires are connected and cable soldered to nozzle, it is good practice to fill the top of the nozzle around the cable wires and flood the floor with a thin layer of compound.

Treated waterproof fiber is used to protect jumper wires where they pass through steel base and side panels.

Fuse holders are made under Cook patented design, and keep fuse under permanent tension. They permit fuse to be easily installed and removed, yet hold it securely. Lightning arresters are held under permanent tension by a separate spring. These springs being of phosphor bronze, will last indefinitely.

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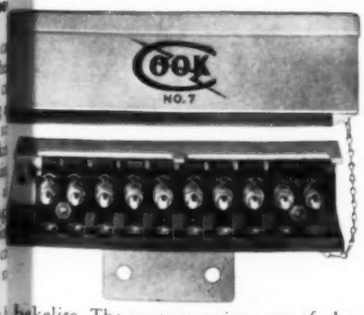

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Capacity, 10 wires.

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Manufactured by

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Consists of two insulated tinned copper conductors, twisted together without outside coverings.

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A weather-proof and fire-proof protector that may be mounted indoors or outdoors.

Base and back is a single piece of heavy white glazed porcelain, so made that surface leakage is eliminated. The hood fits tight to the sides and bottom of the porcelain, the galvanized bracket acts as a stop. The hood, of Everdur, is grounded through a guide at the top of the arrester.

Phosphor bronze fuse clips are securely fastened to the porcelain by oval head brass screws. Fuses are 5-ampere capacity.

Lightning arresters are ground on a copper ground strop. Furnished with True Gap Dischargers that will not permanently ground the line.

Line and instrument wires are connected on opposite sides of the porcelain. Line wires are drawn through holes in the porcelain base and terminate on the face of the porcelain under hexagon brass nuts. Instrument and ground wires enter through holes in the base and are taken up back of the porcelain to binding posts.

Stromberg-Carlson

No. 1501 Stromberg-Carlson Friction Tape

Stromberg-Carlson Friction Tape is made of a strong closely woven cotton fabric which is thoroughly saturated with an adhesive insulating compound that retains its sticking qualities through all seasons.

165 feet of tape per pound. ¾-inch black. Put up in ½-pound rolls.

Columbia Gray Label Dry Cells

With Fahnestock Connections

This battery is especially designed for telephone work and light-drain service.

Screw connections are furnished upon request.

Voltage, 1½.

Diameter, 2½ inches.

Height, 6 inches.

Quantity in standard package, 25.

Approximate weight of standard package, 57 pounds.

No. 6 Ray-O-Vac Dry Cells

For Telephone Service

Equipped with screw binding posts, but can be supplied with flat spring brass connectors.

Size, 2½x6 inches.

Standard package, boxes, 25. Weight, 53 pounds.

Klein's Side Cutting Pliers

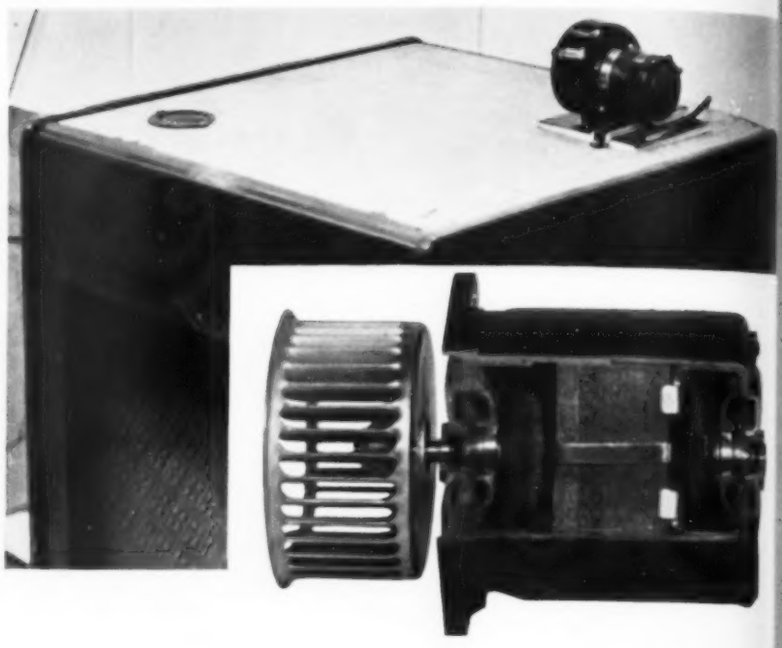
Diamond special for use on bare and insulated wire. 6, 7, 8 and 9-inch sizes.

Klein's Long Nose Pliers

Without Cutters

Adapted for stripping the ends of insulated wire and for work in confined spaces. 5 and 6-inch sizes.

"BON-AIR" BOOTH VENTILATOR



By means of the "Bon-Air" Telephone Booth Ventilator . . . a new departure in booth ventilation . . . air is kept constantly in motion and changed in the booth. The unit is mounted out of sight on the top of booth at rear. Fresh air is supplied to the interior of the booth through fibre tubes in conjunction with ceiling fixture.

The intake fixture admits the air to the interior of the booth and provides perfect ventilation. Used air is vented through a fixture provided with another fibre tube for conducting the air to the outside of booth. Lead wire from motor is conducted to light box on the top of the interior ceiling so that when the door switch is closed and the light is ... ventilating unit is placed in operation.

The motor used is of superb construction ... being provided with a three-eighths inch ... shaft through diamond bored bronze bear... ings. These bearings are provided with large ... oil sumps, wick fed bearings, and only need ... attention over long periods of time.

For direct current operation a special type ... motor is supplied.

A unit of this type is not to be confused with ... the ordinary electric fan which does not ... ventilate.

SUB-CYCLE RINGING MACHINE

A ringing machine of improved design that will do ... ringing better and at lower cost. Operating on A.C. the ... Cycle Ringing Machine economically produces a pow... ringing current. It is *designed with no moving parts* to wo... and requires no adjustments. Does not interfere with ... reception.

Input	Output, 20 Watts
110 to 115 volts, 60 cycles	75 to 90 volts, 20 ...
110 to 115 volts, 50 cycles	75 to 90 volts, 16⅔ ...
220 volts, 60 cycles	75 to 90 volts, 20 ...
220 volts, 50 cycles	75 to 90 volts, 16⅔ ...

Stromberg-Carlson

1937

BUYERS' GUIDE
and
DIRECTORY NUMBER

HOW TO USE THIS DIRECTORY

If you want to know the names of one or more manufacturers or jobbers making or selling a certain product, look in Section 1, where that product will appear in its proper place in the listing. For the complete name and address of any manufacturer or jobber look in Section 2. If you have the trade name of a product and want to know who manufactures it, look in Section 3, where trade names are alphabetically listed.

● The manufacturers and jobbers whose names are spotted throughout the listings advertise their products in this issue. Turn to Index to Advertisers, page 106, for the page on which you will find the advertising of any of these manufacturers and jobbers.

Editorial Section of

TELEPHONE ENGINEER
MANAGEMENT • ENGINEERING • MAINTENANCE

JANUARY, 1937
Chicago, Ill.

Telephone Engineer

1937 DIRECTORY NUMBER

● Section 1---PRODUCTS CLASSIFIED ●

ACCOUNTANTS AND AUDITORS

● Bowdle, F. A., Wheaton, Ill.
Coffey System & Audit Co., Indianapolis, Ind.
Engineering & Management Co., Lima, O.
● Herdrich & Boggs, Indianapolis, Ind.
● Larkin & Co., John C., Syracuse, N. Y.
● Russell, C. B., Columbus, O.

ADDING MACHINES

Burroughs Adding Machine Co., Detroit, Mich.
Felt & Tarrant Mfg. Co., Chicago, Ill.
Monroe Calculating Machine Co., Inc., Orange, N. J.
Remington Rand, Inc., Buffalo, N. Y.
Underwood Elliott Fisher Co., New York City.
Victor Adding Machine Co., Chicago, Ill.

ADDRESSING MACHINES

Addressograph-Multigraph Corp., Cleveland, O.
Elliott Addressing Machine Co., The, Cambridge, Mass.

ADVERTISING—DIRECTORY

Beatty Directory Co., Geo. F., St. Paul, Minn.
● Berry & Co., L. M., Dayton, O.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
Loomis Advertising Co., Kansas City, Mo.
Welker, J. H., Canton, O.

AERIAL CABLE RINGS

See Rings—Aerial Cable

AIR COMPRESSORS

● Albertson Electric Co., Milwaukee, Wis.
American Chain Co., Inc., Bridgeport, Conn.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
● Burning Brands Co., Chicago, Ill.
Cleveland Tractor Co., Cleveland, O.
Gardner-Denver Co., Quincy, Ill.
Homelite Corp., Port Chester, N. Y.
Schramm, Inc., Westchester, Pa.

AIR CONDITIONING SYSTEMS

● Albertson Electric Co., Milwaukee, Wis.
Betz Unit Air Cooler Co., Kansas City, Mo.
Carrier Engineering Co., Kansas City, Mo.
Curtiss Pneumatic Machinery Co., St. Louis, Mo.
● Graybar Electric Co., New York City.
Stephenson Engineering Co., Auburn, N. Y.
Trane Co., The, LaCrosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wing Mfg. Co., L. J., New York City.
Wood Industries, Inc., Gar, Detroit, Mich.

AIR FILTERS

● Burning Brands Co., Chicago, Ill.
● Albertson Electric Co., Milwaukee, Wis.

ALCOHOL TORCHES

See Torches—Self Acting, Alcohol

ALL-RELAY SWITCHBOARDS

See Switchboards—All-Relay

ALTERATION OF INSIDE AND OUTSIDE PLANT

National Trading & Construction Co., Chicago, Ill.

AMMETERS

See Electrical Instruments—Ammeters

AMPLIFIERS—TELEPHONE

ANCHOR RODS

See Rods—Anchor

ANCHORS—CONCRETE

● American Automatic Electric Sales Co., Chicago, Ill
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Operadio Mfg. Co., St. Charles, Ill.
Rawlplug Co., Inc., The, New York City.
Star Expansion Bolt Co., New York City.

ANCHORS—FIBRE, FOR SCREWS

Rawlplug Co., The, New York City.

ANCHORS—GUY

● Aiken Anchor Co., St. Louis, Mo.
Alamo Iron Works, San Antonio, Tex.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Copperweld Co., Glassport, Pa.
Electroline Co., Chicago, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
Hubbard & Co., Pittsburgh, Pa.
Iron Products Corp., La Crosse, Wis.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
Specialty Device Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Weyerhaeuser Pole Co., Minneapolis, Minn.

ANCHORS—HAND DRIVEN

● Aiken Anchor Co., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

ANCHORS—RECLAIMABLE HYDRAULIC

● Aiken Anchor Co., St. Louis, Mo.

ANCHORS—SCREW

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.

● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
● Porcelain Products, Inc., Findlay, O.
Railroad Repair & Supply Co., Chicago, Ill.
Star Expansion Bolt Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

ANCHORS—TWIST

● Allen Electric Co., The Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

ANCHORS—WOOD

Meredith Co., Wm. C., Atlanta, Ga
National Lumber & Creosoting Co., Texarkana, Tex.
Niedermyer-Martin Lumber Co., Portland, Ore.
Standard Cedar Co., Minneapolis, Minn.
Texas Creosoting Co., Orange, Tex.
Wykoff Pipe & Creosoting Co., Inc., The, New York City.

ANNUNCIATORS

Couch Co., Inc., S. H., North Quincy, Mass.
Edwards & Co., New York City.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Stanley & Patterson, Inc., New York City.

APPRAISALS

See Engineers—Appraisal, Consulting, Valuation, Contracting

ARMS, BRACKETS AND HOLDERS—TELEPHONE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B. Centralia, Mo.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Hatheway-Patterson Corp., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Hubbard, A. N. Co., Pittsburgh, Pa.
Hurt & Co., Ferrum, Va.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
National Electric Products Corp., Pittsburgh, Pa.
● National Telephone Supply Co., The, Cleveland, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Vreeland, B. F., Denver Colo.
● Western Electric Co., New York City. (Distributed by Graybar)

ARRESTERS—LIGHTNING

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Illinois.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
British Insulated Cables, Ltd., Prescot, Lancashire, Eng-
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Cook Electric Co., Chicago, Ill.
General Electrical Co., Ltd., The, Coventry, England.
Hoppe Engineering Co., Indianapolis, Ind.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
National Electric Specialty Co., The, Toledo, O.
Porcelain Products, Inc., Findley, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Seeger Device Co., Toledo, O.
Shaw Insulator Co., Irvington, N. J.
Speer Carbon Co., St. Marys, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Sundt Engineering Co., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

AUGER BITS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
● Graybar Electric Co., New York City.
Greenlee Bros. & Co., Rockford, Ill.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Railroad Repair & Supply Co., Chicago, Ill.
Snell Mfg. Co., Fiskdale, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

AUGERS—EARTH

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Fence & Wire Co., The, Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Coffing Hoist Co., Danville, Ill.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
Hydrauger Corp., Ltd., San Francisco, Calif.
● Iwan Bros., South Bend, Ind.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
Snell Mfg. Co., Fiskdale, Mass.
Specialty Device Co., The, Cincinnati, O.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

AUGERS—HYDRAULIC

Hydrauger Corp., San Francisco, Calif.

AUGERS—MASONRY

Hubbard & Co., Pittsburgh, Pa.

AUTOMANUAL SWITCHBOARDS

See Switchboards—Automanual

AUTOMATIC SWITCHBOARDS

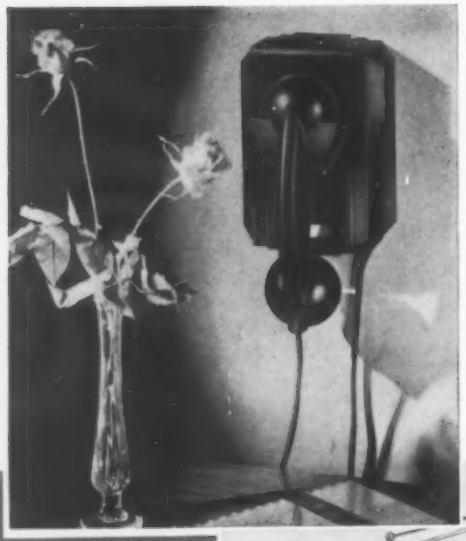
See Switchboards—Automatic

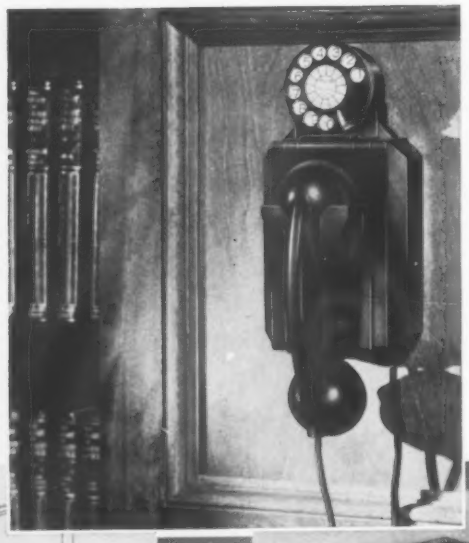
AUTOMATIC TELEPHONES

See Telephones—Automatic

AXES AND HATCHETS—LINEMEN'S

Everything FOR TH OPERAT





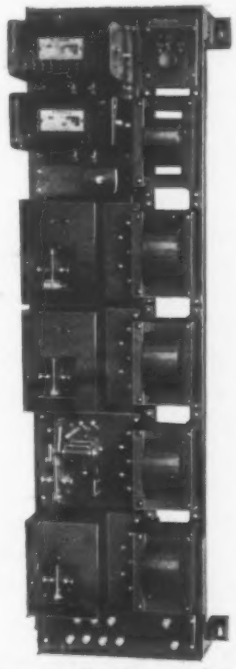
No. 90 C. B. Handset Telephone

LEICH ELECTRIC CO. GENOA, ILL.

Leich Self Contained Handset

Construction — Rugged
Appearance — Beautiful
Light Weight — Stands Up

Universally Approved by Subscribers



Harmonic Converter

1. Steel Frame	Fireproof Panels Vacuum Impregnated
2. Transformers	Will Not Break Down
3. Vibrator	Adjustment Permanent
4. Circuit	Reduces Arcing
5. Battery Rectifiers	Increases Life With Or Without Charging
6. Frequencies	Any Combination Desired
7. Cycles	16—30—42—54—66 or 16-2/3—33-1/3—50—66-2/3

No. 70 Magneto Handset

No. 70 Magneto Handset

Constructed of the Finest Materials
Reduces Stock
Modernizes Present Equipment

Any Conventional Bell Box Can Be Used Or Equipped With Bell Box As Shown.

Bell Box

EQUIPMENT THAT STANDS UP

Editorial « « «

A Timely 1937 Buyers' Guide

This Buyers' Guide Number comes to you at a most opportune time. We say this because of the unprecedented rise in cost of materials needed by the telephone industry. Immediate use of the Buyers' Guide Section is suggested to those of you that need materials for the coming year. These higher prices for basic metals mean nothing else but HIGHER PRICES FOR ALL EQUIPMENT!!

In fact, the writer would like to call this to your attention more as a warning than a suggestion. Pole line hardware has already jumped 15% in price. Lead and copper, both basic metals for the industry, have listed gains of 25% and 20% respectively for the year just ended and it would not be surprising to those familiar with the upward trend of prices to see a price increase in not only line equipment but inside materials during the next 30 to 60 days. The price increases are justified and seem to be as sure to come as 1937 is to surpass '36. There is no alternative for the manufacturers; and telephone men with this in mind should take steps, right now, to survey their needs for the year and communicate with companies handling their particular wants, then order immediately.

Taxes just taking effect and others expected in the near future only strengthens our message and argument that immediate action is necessary if you want to take advantage of present prices and conditions in your favor.

So we say the Buyers' Guide Section comes to you at an opportune time. It is complete, up-to-date and simplified for immediate use. It is larger than the 1936 Directory and contains 48 pages of listings on tinted paper. Consult this ready reference at once and reap the benefit. Our pledge of last year, when the Buyers' Guide first appeared, has been answered this year by its acceptance by the trade, the manufacturers and telephone operating men. IT SHOULD REMAIN ON YOUR DESK FOR READY REFERENCE DURING 1937!!

TELEPHONE ENGINEER
MANAGEMENT · ENGINEERING · MAINTENANCE

JANUARY, 1937

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

Reorganization . . .

● The functions and personnel of the Federal Communications Commission would be transferred to the Commerce Department and the present Commission abolished under the drastic Government reorganization program which President Roosevelt has submitted to Congress.

In a nutshell, the reorganization of the FCC under the Commerce Department will mean the setting up of the Commission in two sections.

One would be an Administrative Section which would formulate rules, initiate actions, investigate complaints and hold preliminary hearings—in short, all the present regulatory and administrative actions of the present FCC. The other would be the Judicial Section which would sit as an impartial, independent body to make decisions based on records and findings presented by the Administrative Section and constituting an appellate body from the rulings of the Administrative unit.

The Administrative Section would be a regular bureau or division of the department, headed by a "responsible" chief with government career tenure and staffed under civil service, it is proposed by the President. The present staff of the Commission could with a minimum of disruption be molded into the Administrative Section. The present commissioners would assume the status of a judicial section.

The plans for drafting a bill to carry out the Reorganization plan have not yet been made. It is expected, however, that it will be tackled by a joint committee of the Senate and House with the aid of the President's Committee on Administrative Management.

● President Roosevelt asked that he be given the power to shift about the agencies and bureaus in the reorganization. It is believed that the entire revamping will take between two and three years. In his reorganization plan, the Chief Executive is hopeful of accomplishing better management and government with less duplication, overlapping and lost motion of governmental functioning.

The proposal of placing the Independent commissions, like the FCC, under regular departments was considered more revolutionary than any other portion of the President's program. But President Roosevelt in his message to Congress pointed to the committee's views that these independent regulatory commissions which perform administrative work in addition to judicial work threaten to develop a "fourth branch" of the Government for which there is no sanction in the Constitution.

The shifting of the Independent commissions to be under departments, it was stated in the Committee Report accompanying the President's message, would be done for "better management and better housekeeping". The Committee in designating the Commerce Department as the regular department to which the FCC would be transferred stated that under the new program the Commerce Department in addition to its present functions would "enforce laws with regard to manufacturing, merchandising, COMMUNICATIONS and transportation."

● Considerable criticism of the Independent regulatory commissions, such as the FCC, was directed at their present status and functions by the President's Committee. The commissions were described as constituting "a headless fourth branch of the Government, a haphazard deposit of irresponsible agencies and uncoordinated powers. They do violence to the basic theory of the American Constitution that there should be only three branches of the government. The Congress had found no effective way of supervising them. they cannot be controlled by the President, and they are answerable to the courts only in respect to the legality of their activities."

Citing their confusion of powers of both administrative functions responsible to the President and judicial functions, the Committee said that it would be more accurate to term the Commission as "irresponsible" regulatory commissions rather than "independent" commissions. It led to a situation of the commissions having power without responsibility, where the President had responsibility without

power in his relations with these commissions. "The commissions produce confusion, conflict and incoherence in the formulation and in the execution of the President's policies," the Committee report stated.

Then in an important comment on the status of the independent commissions, the Committee stated the following:

The Commissions "carry on judicial functions under conditions which threaten the impartial performance of that judicial work. The discretionary work of the administrator is merged with that of the judge. Pressures and influences properly enough directed toward officers responsible for formulating and administering policy constitute an unwholesome atmosphere in which to adjudicate private rights. But the mixed duties of the commissions render escape from these subversive influences impossible.

● "Furthermore, the same men are obliged to serve both as prosecutors and as judges. This not only undermines judicial fairness; it weakens public confidence in that fairness. Commission decisions affecting private rights and conduct lie under the suspicion of being rationalizations of the preliminary findings which the commission, in the role of prosecutor, presented to itself." (This criticism is similar to one presented by the American Bar Association in its report proposing an Administrative Court to pass regulatory commissions' decisions).

Under the Reorganization plan, the Committee stated that the regulatory agency "would be set up, not in a governmental vacuum outside the executive departments, but within a department;" * * * * the administrative section would be a regular bureau or division of the department, headed by a chief with career tenure who would be directly responsible to the Secretary and through him to the President; * * * * the judicial section would be "in the department" only for the purposes of "administrative housekeeping" for budget, personnel administration and material and would be wholly independent of the Department and the President with respect to its work and decisions, while its members would be appointed by the President with approval of the Senate for long staggered terms. The Committee declared that the plan created effective responsibility for the administrative and policy-determining aspects of the regulatory job and at the same time guarantees the complete independence and neutrality of the work of the judicial section. Under one department roof, too, division of labor and modifying of functions could be worked out by executive order.

● The Committee did not view the proposed plan as "revolutionary or dangerous" and stated that the idea of giving these phases of the administrative process which involve policy and discretion to a different agency from that which issues or makes decisions after the manner of a court is a very old one. The Committee cited as illustrations—the Customs Court, the Court of Claims and the Board of Tax Appeals. This segregation of function "lies at the heart of the proposed plan," the Committee report added.

A close scrutiny of the way in which the present more important regulatory commissions function, the Committee report stated, indicates that the division of functions between the proposed administrative and judicial sections "is merely a formalizing by statutory enactment of the division of labor that has already been set up within the commissions themselves." It was cited that in nearly every case the commissioners have already set up a division of labor, acting upon cases and issuing orders on the basis of records and findings prepared by the administrative staffs.

"It is difficult to see how the transition" of a transfer of the commissions to regular departments, the Report concluded, "could be very disturbing or why the plan should not work smoothly and efficiently."

Spend $300,000,000.00 In 1937

In testimony before the FCC, officials of the A. T. & T. stated that $300,000,000.00 would be spent during the year just starting in replacements, additions and betterment of the service, while being questioned during January hearings of the investigation.

Net additions to the plants of the Bell system companies in 1937 are expected to total in excess of $125,000,000 officials said. Gross expeditures for replacements, additions and betterments in 1936 totaled $243,347,999 and net additions totaled $73,150,000, it was announced.

Total increase in station installations for 1936 by the Bell companies are listed as 889,000 stations against a gain of 461,156 in 1935. The increase for December of 93,000 stations was the largest since 1929 except September and October when over 100,000 stations were reported.

Investigation Hearings Move at Rapid Speed . . .

● Concentrating on engineering subjects, including the cost of various major portions of the telephone plant, the FCC Telephone Investigation moved at a fast rate during December and January. The Telephone Division Commissioners. Paul A. Walker and Thad H. Brown, even gave up their Christmas holiday recess to hold a half dozen days of hearings in New York to conclude a probe into the activities in the motion picture field of Electrical Research Products Inc., A. T. & T. subsidiary.

The most important proceedings of the investigation occurred during the latter part of December upon the subject of the Bell System charges for the use of telephone hand sets. This study was considered a "trump card" of the investigation and won favorable newspaper editorial comment in many leading newspapers. In several states, the governors and state commissions also instituted separate inquiries into the charges as a result of the FCC disclosures, one of the outstanding moves in that direction being taken by Governor Lehman of New York in his inaugural address.

The FCC investigation witnesses charged that the hand set had produced estimated ultimate savings in wire construction costs calculated at $85,391,000, which should have been the basis for reduction of subscribers' rates rather than a source for imposing extra charges on the users of the instruments.

● The FCC testimony, which was mainly given by C. L. Terrel, who cited that he had served with Western Electric for four years, two of which were during college summer vacations, charged that the A. T. & T. and Bell System companies through monthly charges for use of the hand sets had collected from subscribers between 1927 and 1936 total revenues of $53,240,000 which brought in an alleged net profit of nearly $24,000,000. This purported net profit amounted to 45 per cent profit on gross revenue, according to the FCC engineer, and an annual return of 25% on the average annual investment during the ten-year period.

By a series of computations through the combination of purported net profit of $23,895,000 with the Bell System's added expenses of maintenance and operation for the hand sets, the Investigation staff charged that, even though all the present extra monthly rates for the use of the handsets were eliminated on Jan. 1, 1937, that $24,000,000 net profit would be sufficient to defray all added future expenses of the handset until 1950 and still would leave a remaining profit of $11,527,000.

● The Investigation engineering staff compiled a table showing the extra

(Please turn to page 112)

Telephone Transmission
Theory and Practice

By ROBERT A. CLARK, JR.

CHAPTER XII

The characteristics of telephone lines and the design of balancing networks for telephone repeaters are discussed in this chapter.

● You will recall in Chapter XI that for efficient operation of telephone repeaters we must design a network which will closely match the telephone line throughout the voice frequency band. In previous discussions we have mentioned that good voice transmission will be obtained if the transmission frequency characteristics are maintained constant (or approximately so) between 200 and 2,000 cycles. If the band is extended up to 3,000 cycles an appreciable improvement in intelligibility will be obtained. However, with the trend towards the more efficient use of telephone wires by means of carrier current applications it appears desirable in most cases at least, to design our telephone lines and circuits to pass the 200-2,000 cycle band rather than attempt to obtain the improvement in quality by extending the range to 3,000 cycles or higher. Actually, if we design circuits to pass 2,000 cycles, frequencies higher than this will be passed to some extent. This obviously gives some improvement in quality as compared to a sharp cut off at 2,000 cycles.

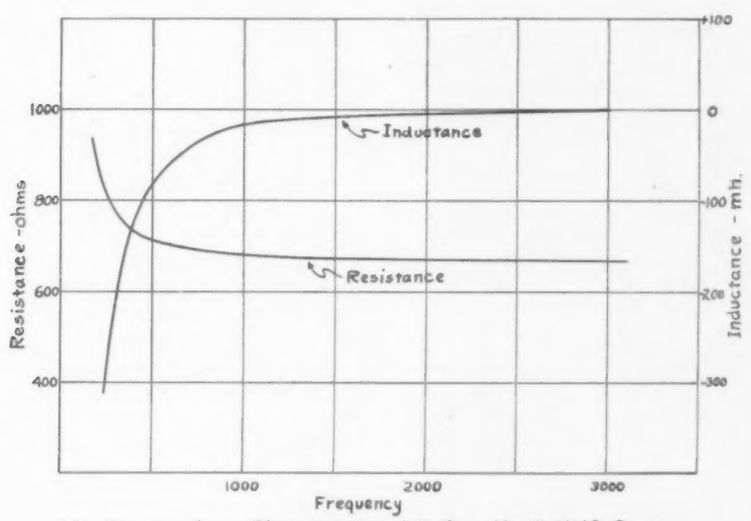


Fig. 60. Impedance Characteristics of Uniform No. 9 AWG Copper Open Wire Telephone Line.

The schematic diagram shown in Figure 58 for a telephone repeater does not include any filter circuits for limiting the frequencies to be amplified. Filters for such purpose vary in type and characteristics over a wide range and we will not attempt at this time to discuss them specifically. In fact with proper design of the transformers the repeater can be given characteristics such that additional filters are not required for most applications.

We will devote our discussion in this chapter primarily to the characteristics of lines which are commonly used for long distance telephone transmission and networks which will simulate these lines throughout the voice band. In measuring the characteristics of a telephone line we employ an alternating current Wheatstone bridge and a variable frequency

Fig. 61
Network For Balancing Open Wire Telephone Circuit.

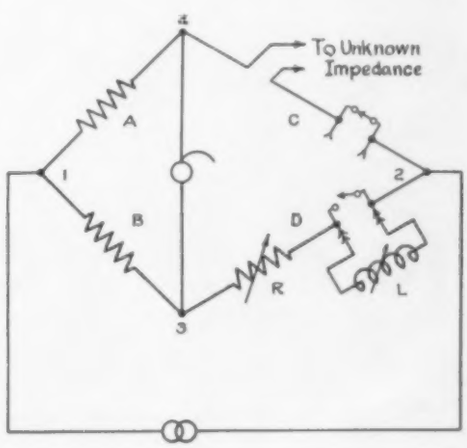


Fig. 59. A-C Impedance Bridge.

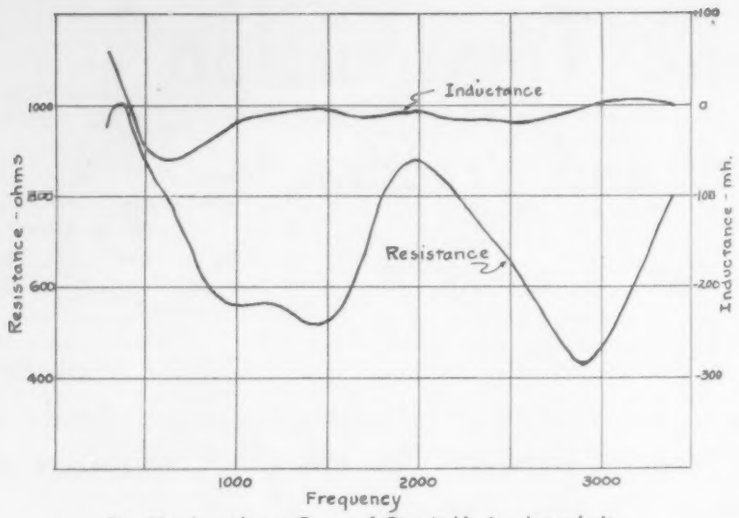


Fig. 62. Impedance Curve of Circuit Having Irregularity Caused by Repeating Coil.

oscillator. The circuit for such a bridge is shown in Figure 59. This bridge operates on the same principle as the D-C Wheatstone bridge with which you are all undoubtedly familiar. However, we will briefly describe the a-c bridge which has a few additional features. Referring to the diagram you will note that there are four arms in the network, A, B, C and D. Arms A and B are non-inductive resistances each equal and having a resistance of approximately 1,000 ohms. For accurate work the two resistances should match within 1 ohm. Arm C extends to the telephone line or other equipment to be measured. Arm D consists of a variable inductance and variable resistance. For telephone measurements the variable resistance should be continuously variable up to about 10 ohms and in steps to permit reading resistance components up to as high as 10,000 ohms. The inductance should be continuously variable and should permit adjustment to within one millihenry. It should be capable of reading values as high as about 1 henry.

● A variable frequency oscillator is connected to terminals 1-2 and a telephone receiver to terminals 3-4. The oscillator is adjusted to a given frequency, and the variable resistance and inductance adjusted until no sound is heard in the receiver. Under such conditions the resistance and inductance components of the unknown which is connected to arm C is equal to the known resistance and inductance in arm D. You will note a switching arrangement in arm C and D which permits the known inductance to be connected in series with the unknown in arm C, thus obtaining a balance when the unknown has a capacity component of reactance. Referring back to our discussion of reactance in Chapter III you will recall from formulas 14 and 15 that the reactance of a condenser can be made equal to the reactance of an inductance at a given frequency or vice versa. As the two are opposite in phase relation, one neutralizes the other and we have left only a pure resistance component which in the bridge arrangement would be balanced by resistance R in the arm D.

In making impedance measurements on lines we start at a frequency of about 200 cycles and obtain a bridge balance at intervals of about 100 cycles up to about 2500 cycles. Where it is necessary to insert the known inductance in series with the unknown (arm C) the impedance characteristic is said to be negative. This is merely for convenience in plotting impedance curves. When the known inductance is in arm D for balance the impedance of the unknown is said to be positive.

● Let us now look at some typical impedance characteristics of a long telephone line consisting of No. 9 AWG copper wire. By long we mean either a line which is of infinite length or one to which is connected a network having impedance characteristics similar to a long line. You will note that throughout the entire frequency range, the reactance is negative. In other words the known inductance would be in the C arm for all readings. For such a case it would have been possible for us to obtain a balance by using a condenser in the D arm in place of the inductance in the C arm. If we were to do so we would find that a condenser of approximately 2 mf would enable us to obtain a balance throughout the frequency range. Those of you who are mathematically inclined may verify this by solving equations 14 and 15 (Chapter III) to see what value of capacity is required to equal the measured inductance at the different frequencies.

We may therefore conclude that a resistance of approximately 675 ohms in series with a condenser of approximately 2 mf capacity will provide a balancing network for a non loaded open wire line. We would find on measuring lines consisting of other size conductors that the equivalent capacity is quite similar. With the larger gauge wire the resistance component will decrease somewhat dropping to about 600 ohms in the case of No. 8 BWG copper wire. Figure 61 shows a network suitable for balancing open wire lines. As mentioned above the capacity should be approximately 2 mf and the resistance from about 600 to 700 ohms depending on the line characteristics.

You will observe that the line characteristics do no match the network very closely at frequencies below about 400 cycles, the resistance component tending to increase appreciably. It is possible to add a parallel resonant circuit to the network in series with the condenser and resistances shown in Figure 61 which will more closely simulate the line characteristics. However, in general this is

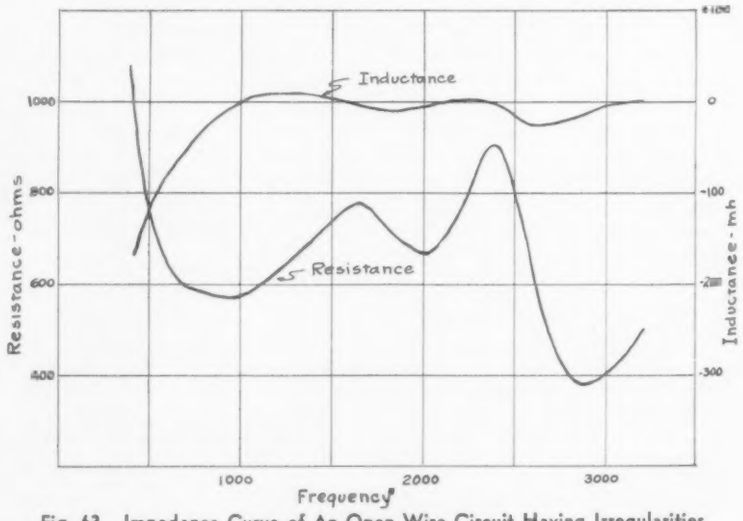


Fig. 63. Impedance Curve of An Open Wire Circuit Having Irregularities Caused by Short Sections of Nonloaded Cable in the Line.

not necessary and the network shown in the figure proves suitable. To partially offset the unbalance between the line and network the gain of the repeater may be reduced at frequencies below 400 cycles so that there will be no tendency to sing. This can be accomplished readily by means of a high-pass filter section inserted in the input section of the amplifier, for example, between the CL18 transformer and the 1221 transformer (Fig. 58). Similarly if for some reason such as the use of carrier equipment, the network does not simulate the line characteristics at the high frequencies a low-pass filter section may be inserted to drop the gain.

In practice, we find that the ideal line characteristics shown in Fig. 60 are seldom obtained. This may be due to any of several causes. The most common one is the insertion of short sections of non-loaded cable in the open wire line. Also, there are many circuits with short taps consisting of a few miles of open wire extending over to a bridged telephone. Anything which tends to change the line characterstics from that shown in the figure is known as an **irregularity.** The effect of such irregularities are mainly to prevent the operation of repeaters at high gain.

For example, if a repeater ware inserted between two sections of open wire each 200 miles in length and having no irregularities we could operate a repeater at a gain of at least 15 db. However, if there was a two mile section of non-loaded cable in one of the open wire lines a distance of 100 miles away from the repeater we might find it possible to obtain a gain of but 10 db. In other words, for good repeater operation we must have lines that are uniform in characteristics and which do not have any irregularities. There are various schemes we can use to obtain uniform line characteristics. For example, loading coils can be installed in cable sections so that the cable will have the same characteristic impedance as the open wire. Way stations, that is bridged telephones along the line, can be modified so that they have a comparatively high impedance. Such a telephone when bridged across the line will have comparatively little effect in changing the line characteristics. A simple scheme for modifying such telephones consists of merely inserting a 1,000 ohm resistor in series with the telephone. This opviously reduces the transmission equivalent to and from the station. However, in most cases this can be tolerated.

● It is interesting to see just what effect irregularities have on the impedance characteristics of the line as measured by the bridge described above. The impedance curve tells us first where the irregularity is and second, how much gain can be obtained from a telephone repeater without singing. This latter feature is somewhat involved and we will not take time to discuss it in this chapter. However, the use of the impedance bridge to locate irregularities is important and it is very desirable to have curves for all circuits involving repeater operation. Fig. 62 shows the impedance characteristics of a No. 9 AWG open wire circuit approximately 150 miles in length which contained a WE Co. type 70 repeating coil 50 miles away from the test point. This repeating coil has a comparatively high equivalent series reactance and therefore has an appreciable effect on the line impedance when used to connect two open-wire sections together. You will observe, that the equivalent inductance and resistance vary in the form of a wave motion above and below the nominal smooth line value. There is a definite relation between the distance to the irregularity from the test point and the frequency difference peaks or nodes of the impedance curve. Knowing this relation, we can compute with a fair degree of accuracy the distance from the test point to the irregularity. The formula for this relation is

$$D = \frac{V}{2f} \qquad (35)$$

Where **D** is the distance from the test point to irregularity in miles, **V** is the velocity at which alternating current travels over the telephone line which on open wire lines is about 180,000 mi. per sec., **f** is the distance in cycles between adjacent peaks of the impedance curves. This value should be obtained by averaging the distances between all of the peaks occurring on both the inductance and resistance curves. In the case of the curve shown in Fig. 62, we find that this average is 1700 cycles. Solving in equation (35), we find that the distance to the irregularity computes to be 53 miles away from the test point; actually it was 51 miles away. Such an irregularity as shown in Fig. 62 could be eliminated by replacing the type 70A coil with a high efficiency low impedance repeating coil.

The effect of two short sections of cable in a 100 mile wire line is shown in

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"Ask her if she's got a friend"

NED HILTON
Courtesy "Colliers"

Association President F. B. MacKinnon Dies

Frederick Benjamin MacKinnon, 64, executive head of the United States Independent Telephone Association for the past 23 years, succumbed to illness at his home in Kenilworth, Ill., January 10th. The suddenness of the stroke, with death following a few hours later, left a mourning circle of friends extending to all corners of the country. Only confidants were aware that Mr. MacKinnon was not in the best of health as he was carrying on even two days prior to his death.

A native of Concordia, Kansas, Mr. MacKinnon entered the telephone business around the turn of the century to become manager of the Lawrence Home Telephone Company, Lawrence, Kansas. He was connected with another telephone company in his native state immediately following, being president and manager of Suburban Telephone Company, but retaining his residence in Lawrence. His steady rise in the telephone industry gained him many friends and in 1912 the Kansas Independent Telephone Association drafted him as secretary of that association.

In that position he laid the groundwork to his life's work. Representing his association in Topeka, the state capitol, to appear before the Public Utilities Commission his worth was recognized by the telephone industry who in turn drafted him in late December of 1913 to become secretary-treasurer of the National Independent Telephone Association.

During the war years from 1914 to 1919 his service to the Industry was invaluable as during that period the government took over operations of all telephones with Mr. MacKinnon serving his Association in Washington, D. C. He in turn served his country with his wonderful assistance to the signal corp. His service and accomplishments during this period of strife was handsomely rewarded.

Selected as president of the United States Independent Telephone Association following the consolidation of the two national associations several years earlier, his service to the industry starting in 1919 was to bring him his well earned recognition from the entire United States. Bringing the Independent group into more effective relation with the Bell group and causing enactment of important legislative matters, the association under his leadership has grown into one of the finest organizations of its kind. His advice and assistance in the late twenties saved many telephone men and companies through his stringent regard to economic values.

Frederick Benjamin MacKinnon
July 1872—January 1937

Having all attributes of his high position, his kindly generous personality won him many friends with a resultant reputation of knowing more telephone men personally than anyone in the Industry. His zeal for the Industry led him as principal guest to many conventions where his earnestness was rewarded by his results in bringing harmony through all the country. These attributes with the regard and love to his family and church caused the minister at his funeral to deviate from the regular ritual that he might utter the kindest and simplest words the ministry can bestow, "He was a good man".

Surviving are his widow, the former Cecil Leland of Eldorado, Kans., two sons, Cyrus Leland, a student at Dartmouth, Frederick Benjamin Jr., senior in high school, and a daughter, Miss Cecilia, now attending Sweetbriar College. A sister, Mrs. Edward Fitch of New York state; and two brothers, D. S. of Milwaukee, and A. R. now serving as secretary of the New York State Telephone Association.

Pallbearers serving at the funeral services January 12th held at the family home were Charles C. Deering, Edward C. Blomeyer, Bob W. Anderson, Stanley R. Edwards, Dudley W. French and David K. Hall.

Resolution of the Association

WHEREAS

The term of office of F. B. MacKINNON as President of the United States Independent Telephone Association was ended January 10, 1937, by a Power from which there is no appeal; and

WHEREAS

FREDERICK BENJAMIN MacKINNON was President of this Association for almost twenty years. In the history of the Independent Telephone industry there has been no other man so peculiarly well qualified to render his great and valuable service to this organization and to the industry it represents. Under his wise and able leadership the Association has been of incalculable value and benefit to its members and to the industry during momentous years, including trying times of war and of depression as well as those of prosperity and of peace.

He established the policies of the Association wisely and administered its affairs ably; he maintained its high prestige throughout all the years of his incumbency. He was a major factor in establishing and maintaining the amicable and constructive relationship now existing between all of the groups of the telephone industry in this country.

He was always helpful, always cheerful, always rendering constructive service. He gave his talents and ability unsparingly upon even the smallest problems of those who needed his counsel. There is no one who can find the place he established for himself in the telephone industry and in this Association.

His loss will be felt for many years and he will be mourned throughout their lifetimes by the thousands of friends, both within and outside the industry, who enjoyed his companionship, respected his ability and admired him as a man.

The Executive Committee of the Board of Directors of the United States Independent Telephone Association, in special meeting, while realizing the futility of words, has respectfully prepared this tribute to FREDERICK BENJAMIN MacKINNON on behalf of the Board, the officers and the members of the Association, and has unanimously

RESOLVED

THAT this resolution be made a part of the permanent minutes of the Association, and that it be given publication, and distribution to the membership, and

THAT a copy hereof, suitably engrossed, shall be presented, with the heartfelt sympathy of all members of this Association, to the bereaved family of FREDERICK BENJAMIN MacKINNON.

(Please turn to page 110)

Portable Electric Tools for Telephone Work

By RAY BLAIN

Smaller details around the plant have their place in major incidences, so this dissertation by Ray Blain, with photographic illustrations by the author, on the value of portable instruments is offered our readers from actual experience.

● It is not believed that the average telephone company fully realize the numerous advantages which may be gained from the proper use of good portable electric tools now available. Not only are these tools useful in the telephone exchange but they may also often be used to good advantage out on the job. Electricity is now available almost everywhere and seldom will anyone object to having a portable tool

Portable electric drill in stand used as drill press.

connected to one of their light sockets for a few minutes if it will ease the labors of a hard working telephone man.

We have constructed some special reels which carry extra long, rubber covered extension cords for use with portable electric tools. One end of the cord is attached to a socket which is mounted in the top of the reel. This reel is located where the portable tools are to be used and the cord pulled-out until a light socket is reached when it is connected. The portable tool is then plugged-in the socket on the reel. This reel arrangement keeps the extra long extension cords free from tangles and available for instant use at all times.

● We are of the opinion that the Electric Hammer drill is one of the greatest labor savers of all time. A good hammer drill will often pay for itself in labor cost alone on one small job. One man with a good electric hammer drill can do more work than a half dozen men with hand drills, in the same length of time. When cleating cable to a wall the drilling of holes is a simple and easy task with an electric hammer. Also when a cable must enter a stone or brick building the entrance hole can be drilled easily with a long drill of either the hollow or star type.

The electric twist drill is also most useful in any telephone exchange. We have one small and one large size and make use of them frequently to good advantage. A wood bit can be placed in an electric drill and used by installers in drilling holes through walls and floors in frame buildings. These power drills will get into corners or close to walls and eliminates the need of a corner brace. We also have a stand which is used to make a drill press of the large electric drill.

● Recently we had a number of timbers to drill in connection with bridge clamp to use on a river crossing. Another time it was necessary to construct a number of special crossarms and complete them with the least possible delay. A 5/8 inch bit in the drill press drilled all the holes in the bridge clamps. A special 1¼ inch bit was purchased and the holes for the pins in the crossarms were bored with accuracy, ease and speed. These drills are used frequently on numerous special jobs, all of which saves both time and money.

A combined Electric Hammer and drill may be obtained if desired. The electric drill part of this tool is of the conventional type and uses ordinary twist drills in metal. Less than one minute is required to clamp on the hammer member which strikes 2400 hard blows per minute. This hammer though light in weight is rugged in construction and will handle all ordinary telephone work with ease. A light weight electric hammer is desirable as it can be handled more conveniently by the man operating it and is much safer when operated from the top of a ladder.

Using combination electric hammer drill.

Using portable paint spray.

This combination drill outfit also has grinding and buffing attachments which may be used to advantage frequently. A special clamp quickly converts the drill into a bench grinder or buffer.

● The portable electric planer and sander is another modern tool which most surely pays its way. This machine does fast accurate wood cutting, also sands a surface smooth and clean much quicker than it possibly can be done by hand. We always use the sander to good advantage in removing old paint from a line or trouble truck. There is also a sheep skin buffer attachment which can be used to advantage in waxing and polishing all autos and trucks.

Recently we purchased some extra long cedar poles and while they were of excellent quality they did have numerous knots which required considerable smoothing down for appearance sake. We tried a draw-knife and a hand axe both of which were slow and with them it was impossible to do a smooth job. Then someone thought of the electric planer and it soon proved the perfect answer to our difficulty. Just one lick with this tool and the knot disappeared completely, leaving a surface as smooth as the remainder of the pole.

One man and a planer completed more work in an hour than four men could have done in a day with hand tools, also much better. We have found this planer useful in the construction of battery racks, headset cabinets, bulletin boards and even the refinishing of switchboard cabinets.

● The portable electric grinder is another good tool so often neglected by telephone people. There are so many odd jobs which can be done so easily and quickly with a good grinder which are so slow and expensive when attempted with a file or other hand method. These electric grinders can be fitted with rag and wire buffing wheels in addition to the various grades of grinding wheels. The buffers are useful for removing rust and in polishing certain kinds of tools.

Recently on a large underground cable job considerable difficulty was experienced in keeping the shovels sharp. We were short of tools and considerable time was lost in taking them to the nearest blacksmith shop. The portable grinder came to the rescue for we set it up right out on the job and a shovel could be made almost as good as new in just a few minutes. After that we set the grinder up each day and went over all the shovels. Only about 30 minutes daily was required to remove all nicks and keep our shovels in good condition at all times.

● Last, but in no small measure least, a small electric portable paint spray completes our set of labor saving tools. This spray if used properly, on most kinds of work, does a much better and quicker job than possible with the old-fashioned hand brush method. This spray has a small compressor belt connected to the electric motor and the complete outfit is small and light in weight. This spray can be successfully used by anyone after only a few minutes practice.

Recently we had a large number of outdoor type ironclad mine type telephones to repaint. This was a slow, tiresome job with a brush, and always looked streaked when finished. We then mixed the aluminum paint a bit thinner, cutting it down with turpentine and found that it worked perfectly in our paint spray. When painted in this manner the phones and their supporting standards had the appearance of aluminum castings the paint was so smooth. We also make use of the spray to paint cable terminals, pole balconies and wood guy guards. This spray is also a real help in the repainting of our cable trailers and line trucks. Only about an hour each month with the spray was required to touch-up the paint on all motor equipment. This is effort well expended for the covering of small scars and paint damage not only keeps equipment looking better but prevents wasteful rust.

Portable planer used to smooth knots on large cedar poles.

● Some telephone men may be of the opinion that electric tools are too expensive to be considered for their particular work. This will prove entirely wrong for while the first cost may be high, if given reasonable care these tools will last for many years. It is surprising also how soon even the most expensive tools will pay for themselves. The labor saving is only one factor which must be considered, for the superior grade of work it is possible to perform with them is something which just cannot be ignored by anyone who appreciates a job well done. Any telephone company will do well to investigate present day portable tools and determine which of them can be worked into their daily routine to advantage and profit.

Freeport, Texas.

Telephone Engineer,
Chicago, Illinois.

Dear Mr. Smith:

To date the writer has not received the December issue of Telephone Engineer.

Do not want to miss the combined articles you have been running, very interesting. About the only way the writer can keep up-to-date with the industry is thru trade papers as we are far away from the large centers. I file all of your issues so can refer to them and if any new dope is put out can look it over and see if it fits in my business.

Weather fine and clear. As W. U. the R. R. and Sulphur company work in conjunction with one another the new poles being placed now will allow me to use them later on. Fishing is good too. Wishing you a Merry Xmas and Happy New Year, I am,

(Signed) E. D. Selmser.

Inductive Coordination and the Rural Electrification Program

By L. J. CORBETT

This timely article will be of much interest to all telephone men having problems with the Rural Electrification Program now progressing. The author is well known, having written a number of treatises during his engineering career.

IN the extension of electric power distribution circuits in suburban areas, now being fostered to a greater extent than ever before, in the Rural Electrification movement, many situations arise in which these circuits are forced by economic factors into rather close physical relationship with telephone circuits already serving those areas. In some instances the power and telephone circuits are carried on pole lines on opposite sides of the roadway. They may be "joint" on the same poles, or the power line may overbuild the telephone line irregularly. The power circuits are not affected appreciably by such juxtaposition, but the operation of the telephone circuits may be adversely affected unless care is taken in planning the work.

Serving power to a sparsely settled rural area at a reasonable cost calls for different types of line construction from those which are common in urban territory where loads are heavy and profitable. Methods are sought to lessen the construction cost with the least sacrifice to safety, and with avoidance of too heavy maintenance expense.

● More chances are taken with communication lines than with power lines, as no electrical hazards are involved. If one wire of a communication circuit breaks, only one circuit is affected, and the few subscribers on that circuit are temporarily discommoded in their use of a comparatively inexpensive service. If the power circuit fails, the electrical hazard may be considerable, and may involve shutting off several users of appreciable blocks of power, thus interfering with scheduled operations, as well as the delivery of power load, and also, it may introduce a hazard, of fire, personal injury, or life, on other power or communication circuits, depending upon the circumstances of the failure.

Though at times a communication service may be of considerable value, admittedly its average value is far lower than that of the average power service, both to customer and company.

The physical hazard is provided against so far as is economically practicable by the modified line construction rules now applying in several state commission jurisdictions, so attention will be given here to the inductive coordination features, with only such reference to construction as may affect them.

● To most readers of TELEPHONE ENGINEER an understanding of the fundamentals of induction may be taken for granted. That current in a conductor is accompanied by a magnetic field in the surrounding medium, always varying with the value and direction of the current; that voltage is induced in any conductor in a changing field, proportional to the rate of change; that voltage on one conductor induces an electric charge of opposite sign of any other conductor in the vicinity, always proportional to the instantaneous value of the inducing voltage; and that current will flow through any completed circuit if a voltage is applied or induced in any part of it—these are fundamentals which are treated in more or less detail in books on electrical engineering, or, specifically, on inductive coordination.

When a communication circuit parallels an alternating-current power circuit, effects are produced from the current (magnetic induction) and from the voltage (electric induction) of the power circuit. At times one effect or the other predominates; the complete effect is a combination of the two.

● **Transpositions,** or relative interchanges of position of the conductors of a circuit, are used to nullify, so far as practicable, the inductive effects.

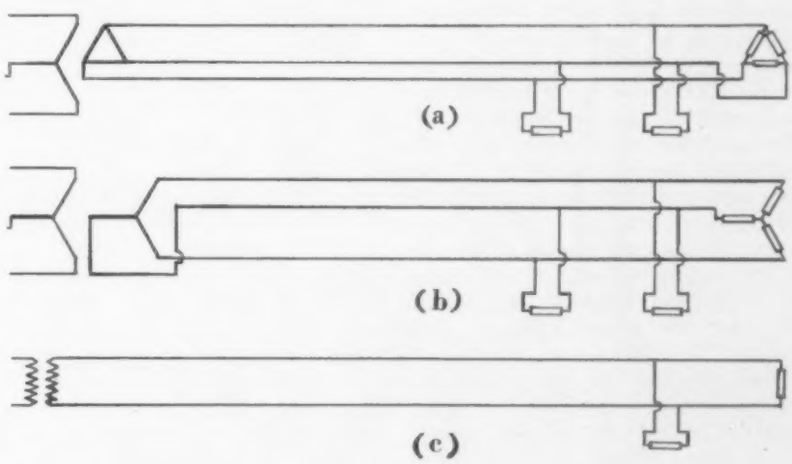

Figure 1.

Power Circuits Normally Balanced

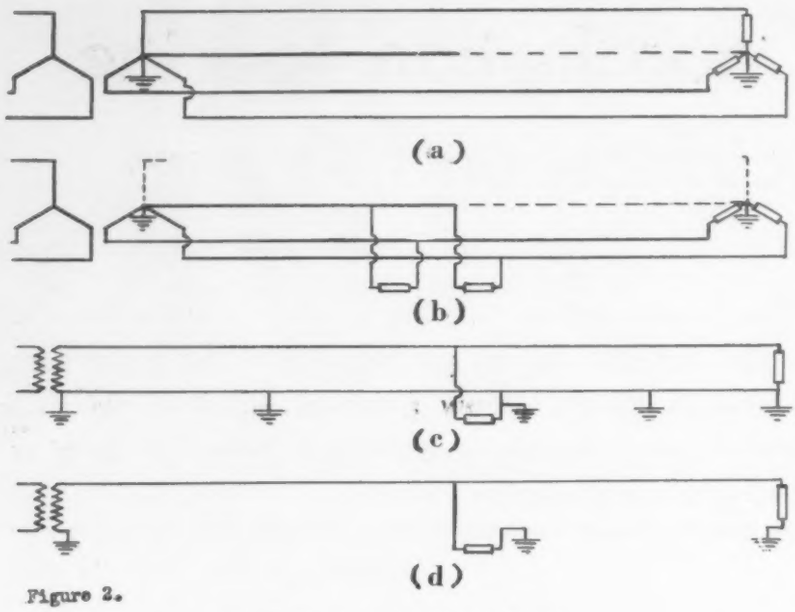

Figure 2.

Power Circuits Normally Unbalanced

In power circuits with certain connections transpositions may be installed in such a way as to reduce the total resultant induction on a parallel conductor to zero. With other connections of the power circuit, transpositions in that circuit are not fully effective. Transpositions may be installed in a metallic (two-wire) telephone circuit so as to equalize the induction in the two conductors, thus reducing the tendency for induced current to flow from one to the other through connected receivers, causing noise. Transpositions cannot, of course, be installed in a "grounded" circuit, consisting of a single wire with ground return.

In inductive coordination we have to deal with "balanced" and "residual" voltages and currents on a power circuit, and their effects upon a telephone circuit exposed to it.

Balanced currents in a power circuit are those currents which are confined to the wires of that circuit. Residual currents are those components which use the wire or wires (in parallel) as one conductor and the earth as the other conductor, of a circuit.

● Balanced voltages are those whose instantaneous values at each instant add (algebraically) to zero, and whose vector sum is zero. Residual voltages are the vector sums of the voltages of the conductors above ground.

We use the terms "currents" and "voltages" here because we are actually dealing with currents and voltages of various frequencies, which are combined in the main current and voltage of the power circuit. Some of these are ordinarily balanced, and some become residuals when certain connections are used. In detailed studies certain refinements in these statements are necessary for some conditions, but the above definitions will serve our general purpose here.*

Power circuits which are practically balanced are those completely isolated from ground, such as [Fig. 1, (a) and (b)] three-phase circuits from delta or isolated-Y connections, serving three-phase delta- or isolated-Y-connected loads or single-phase loads across the phases; and [Fig. 1 (c)] circuits from pure single-phase connections. Here current flowing out on any one wire returns on the other wire or wires.

● Lines may become more or less unbalanced as to current or voltage or both, when the circuit is at any point connected to ground. Such are: a three-phase Y-connected line with grounded neutrals [Fig. 2 (a)]; a circuit consisting of two wires of such a circuit, with or without a neutral conductor [Fig. 2 (b)]; a single-phase circuit consisting of one phase wire and a neutral wire having one or several ground connections [Fig. 2 (c)]; and (completely unbalanced) a single-phase circuit consisting of one phase wire with ground return, [Fig. 2 (d)].

When a three-phase line has a neutral connection to ground at the source end only, the **current** may be balanced, but residual **voltages** may be present. If there are other points on the neutral wire connected to ground, at the loads or elsewhere on the line, any unbalanced load current will flow through the earth, as will also any currents of the third-harmonic frequency and its odd multiples which may be present.

● If a power circuit carries only balanced currents, both the magnetic and electric fields, due to the currents and voltages respectively, are nearly zero at ordinary roadway separations or

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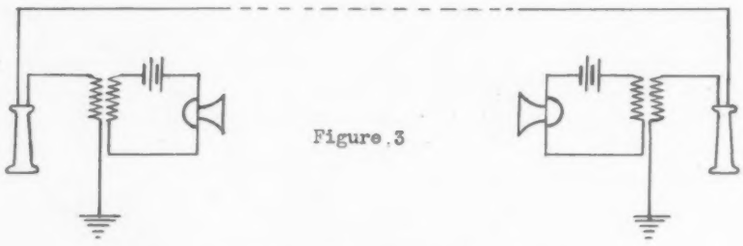


Figure 3

Grounded, or Ground-Return Telephone Circuit

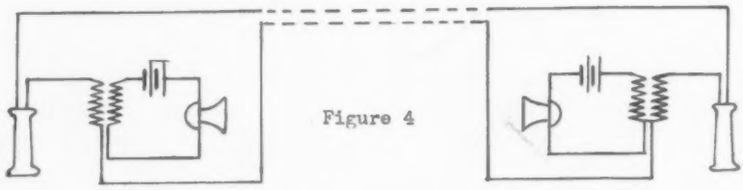


Figure 4

Metallic Telephone Circuit

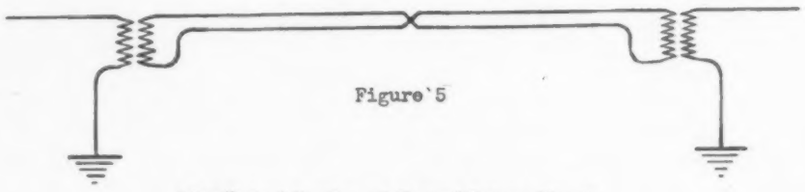


Figure 5

Metallicized Section of Ground-Return Circuit

Who Pays The Bill?

By J. H. Agee

This timely discussion on cost and accounting following construction to reduce inductive interference is by the new head of the United States Independent Telephone Association, having succeeded the late F. B. MacKinnon.

●At the last National Convention of the United States Independent Telephone Association, held the middle of October, this year, one of the very live topics which attracted a great deal of attention, particularly in the plant division, was the subject of inductive interference following the widespread program of the Rural Electrification Administration (R.E.A.).

Some interesting figures were presented. Mr. A. L. Stadermann, Chief Engineer of the Citizens & Independent Telephone Company, of Terre Haute, stated that in the first six months of 1936, 71,243 farms were supplied with electric service, making a total of 860,000 farms through-out the United States which were now using electric current. During the year the R.E.A. had approved loans in excess of $23,000,000 to various cooperative electric distributing companies throughout the country and under the program announced by the National Administration the ultimate goal would be to make electricity available to every farm in the country.

● This intense development of electric distribution spells a good deal of trouble for the telephone industry, more particularly in those sections of the country where grounded telephone service is still predominant. Statistics are not available covering the number of rural subscribers in the United States who are being served with grounded telephones but probably a fair estimate would be that 50% of the rural phones, including rural subscribers on the Bell System are still supplied with grounded service.

The subject of inductive interference is far from new. All telephone companies have been confronted with the problem of making their grounded lines metallic and providing proper balances whenever any power company energized a power line, whether for general transmission purposes from town to town or for the purpose of supplying rural subscribers with electric energy.

Heretofore the cost of converting a grounded line to metallic has generally been borne by the telephone company. Rates have been adjusted accordingly and the only item of cost which the power company has borne has been the cost of moving existing lines from one side of the road to the other or any other expense incident to such change which would properly be charged to maintenance or expense. The practice has not been to ask the power companies to make capital investments for the telephone industry.

● However, the present program of rural electrification is on such a broad basis that it reaches the smaller communities, many of which are served by mutual telephone companies or com-

J. H. AGEE
Acting President United States Independent Telephone Association succeeding the late F. B. MacKinnon

panies with limited financial resources. Introduction by the power people of the use of uni-grounded or multi-grounded neutrals in wye-connected circuits in rural power and distribution lines has aggravated the amount of interference reflected in the grounded telephone lines. All over the country the smaller companies have rushed to their Commission asking for protection or relief from interference with their service.

Confronted with the fact that such partially grounded electric lines will actually make it impossible for the telephone companies to longer furnish grounded service, the immediate and primary question then becomes, "Who will pay the cost of 'metallicizing' and balancing the telephone lines?"

At the Convention in Chicago many answers were given to this question. The first one seemed to be, "Let the power companies pay the cost." In several states Commissions had already indicated their willingness to make such orders and in one case before the Nebraska Commission such an order had been issued and was being complied with by the power company. There seemed to be a majority opinion favoring that procedure.

● Another suggestion was for the telephone company to pay the bill in the first instance and then spread the cost over a period of months to the subscriber, letting him reimburse the telephone company and after doing so, then to continue providing him with metallic service at a grounded rate.

Other suggestions were to divide the cost with the power company, playing the part of the big brother to the power company.

Regardless of the motives back of these suggestions, it seems to us that there is only one proper and sound solution to the problem and that is for every telephone company which operates grounded lines or lines with certain types of ground connections, such as push buttons on metallic lines, to do its own converting and make its own changes which affect the investment in telephone property. The reasons for this become apparent after a little study.

● For example: Suppose the power company distribution system parallels one hundred miles of rural lines in a community with grounded telephone service. Assume $25.00 per mile is the cost of making the telephone line fully metallic. The total additional investment would be $2,500.00. If the power company pays this bill, it has con-

A night panorama of the recently completed San Francisco-Oakland Bay Bridge. The Pacific Tel. & Tel. building is shown on the extreme right beautifully illuminated. Ground broken on July 9, 1933, the completion in 1936 broke world records. It is the longest in the world, being 8¼ miles; it necessitated removal of submarine cable by the above mentioned telephone company; 70,000 miles of wire used for two strands of 28¾ inch cable; specially designed communicating equipment in all construction was an integral part in building this engineering feat. The searchlights to the rear are from a flotilla of battleships.

tributed $2,500.00 of telephone plant to the telephone company. How will the telephone company account for this on its books. Under the latest rulings of the F.C.C. this item must appear as a contribution to the company's property in account number 175. The company's right to make any charge for the use of that added property or to earn anything on the contributed amount is seriously questioned.

If the telephone company receivies the investment as a contribution, must it provide the metallic service to its subscribers at the same rate which it previously provided grounded service? If so, is it discriminating between any subscribers who might continue to be served with grounded lines either on the same or neighboring exchange?

● Assuming it is a gift, what will the tax assessor say about the value of the property owned by the telephone company at the next assessment period? When the lines goes down in a storm, is the power company going to replace it? Who is going to provide the money for depreciation and maintenance on the contributed property?

After all, if the power company pays for making your lines metallic, what have you saved? Actually you have only saved the cost of money and while it is a considerable item in itself, on the basis of today's money market it is only one-fourth of the annual charges which the telephone company must meet in maintaining and providing service over metallic circuits.

In other words, unless you increase the rate to the subscriber even though the power company should pay for all of the immediate cost of converting your grounded lines to metallic, the day will come when you will have to replace this wire and have no money with which to do it and in the meantime you will have had to pay taxes and maintain the added plant from year to year.

What about the suggestion of letting the subscriber pay an added rate for two or three years in order to recover the investment and then provide him with metallic service at the former grounded rates? The answer is the same. Such a procdure would be unsound and unfair and, technically, illegal.

● Of course we recognize that there are hundreds of small companies who pay no attention to annual charges, who give no consideration to replacement of their property until it is entirely impossible to render service with it, who keep no books other than to make a record of assessments and collections, and whose rates for service are not subject to regulation or control. In those instances, the power companies should probably pay the cost of the change and the mutual subscriber will not morry about the matters of depreciation and maintenance, but in the cases of the larger companies, where capitalization is important and where the operation of the company has due regard to a reasonable return on its investment, it seems to us that the cost of "metallicizing" the lines or any other capital investment incident to protecting the telephone service from inductive interference should be borne by the telephone company and the annual additional cost reflected in the rate charged for telephone service.

When the Rural Electrification program was first announced and the cost of constructing rural lines in individual cases was submitted to the R.E.A. for approval of grants and loans, no amount was included for cost of reducing the effect of inductive interference upon communication lines. The protest which was received from the telephone companies brought this matter to a head rather quickly and we understand that the R.E.A. Board agreed that the local electric distributing companies could include in their estimates of construction costs, a proper amount to reimburse the tele-

(Please turn to page 115)

By G. HAMILTON

An up-to-date farm where good telephone service is a necessity.

Routine Inspection of Rural Lines

Rural lines present many problems. This article discussing Routine repairs, Leakage, and Tree interference is indeed timely and a suggestion to companies endeavoring to keep their equipment and service of the best.

ROUTINE Inspection of rural lines helps to insure uninterrupted service, and tends to keep the entire system running smoothly at all times. Theoretically speaking, rural lines should always be in as good a condition as when first constructed.

In order to do this, deterioration must be kept at a minimum, by applying corrective maintenance. It is of primary importance that all unsatisfactory conditions of lines discovered on routine inspection receive immediate attention, especially those conditions of a hazardous nature that might cause possible damage to property or injury to persons.

● In as much as routine inspection consists of the preparatory work prior to making needed repairs to the line equipment, it may be necessary for the repairman to cover portions of the line on foot in order to locate existing faults.

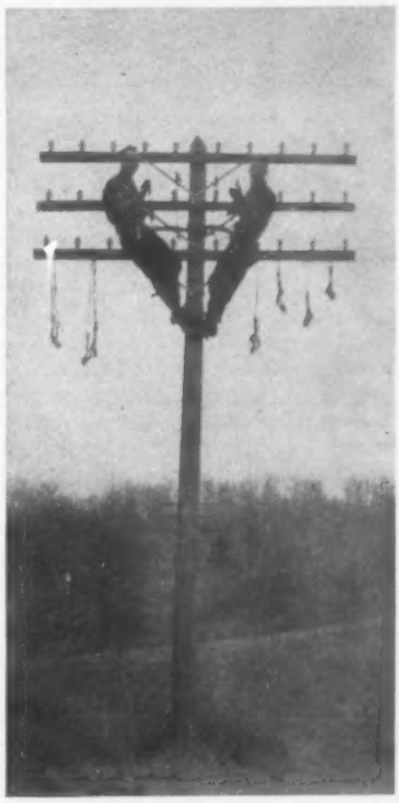
Items usually found on inspection are: tree and brush interference, broken pins, wire lying on cross arms, broken or missing insulators, wire tied directly on pins or coming in contact with pole guy. Broken or loose tie wires, loose transposition brackets, slack lines, leaning, broken, burned or decayed poles. Broken cross arms, and loose pole guys.

It is never economical to delay performing line inspection routines, as this tends to the probable development of transmission losses, noise, cross talk, and etc.

● It must be understood that routine repairing differs from ordinary repairing in that it is a preventive measure, whereas regular repairs is the work done clearing reported trouble.

As the result of making routine inspections, repairs now become necessary in the following manner. (1) Poles found to be broken, rotted or burned off at the ground level are a source of danger which may cause other poles in the line to break during a storm from the lack of sufficient support from the imperfect pole.

If rotted or broken poles are in good condition above the ground, they may be reset or reinforced by setting a stub pole (stub cut from an old pole) placed in the ground and then bound together by means of line wire. If the upper part of the damaged pole is not in a serviceable condition, then it should be replaced by a good pole of the same type.



Linemen cutting slack out of line wire.

Poles located near railroad right of ways are some times destroyed by grass fire. In order to prevent this, the grass should be removed for a distance of 3 or 4 feet around the poles and the poles well banked with sand, gravel or stone before the grass near the poles dries out.

Unauthorized attachments on poles, such as advertisement cards, metal signs, guide boards, and etc., should be removed because of possible danger to workman climbing poles.

● (2) Slack guys weaken the pole lines causing trouble, especially where side guys pass through the line wires, and should be pulled up tight. Anchors lifting on account of soft ground, or being improperly set, will result in the guy becoming slack, and should be reset or a new anchor placed before pulling slack in the pole guy wire. Occasionally it is found that a guy is tied to a cross arm with a piece of wire to clear a case of line trouble. While this may be considered necessary to clear the trouble temporarily it is none the less very bad maintenance practice and should be avoided. The best plan is to make the needed repairs at once and thereby prevent trouble later.

● (3) When a cross arm is found broken, split at the ends, rotted, or the pins loose, it should be replaced. Particular

attention should be given to cross arms on corner poles as they are usually subjected to more strain than poles in a straight line. If the cross arms on corner poles show the slightest evidence of decay they should be replaced immediately.

● (4) Transposition brackets occasionally work loose, due to the nuts and bolts not being securely tightened. This causes the brackets to lean and the top portion may come in contact with a line wire and thus cause trouble. Such brackets should be straightened to a vertical position.

● (5) Slack line wire is frequently responsible for intermittant trouble on rural lines. When the slack exceeds twelve inches to a span it should be pulled up and the slack wire cut out.

Slack wire often develops due to corner poles giving slightly, or from breaks where the wire had not been pulled up properly when repaired. To correct this condition, first untie all corner wires on each side of the corner as far as the slack in the wires exists, then pull the pole back to its original position and make rigid, then when the line wires are retied to the insulators the slack will have disappeared without any wires having been cut.

When cutting slack out of any line wire to be pulled up to alignment with other wires, opening of the circuit may be prevented by equipping a piece of No. 12 B & S gauge insulated flexible copper wire 4 or 5 feet in length with suitable spring type cord clips and connect one clip to each grip of the slack blocks holding the line wire being cut. This will keep the circuit closed while the slack is being cut out and the wire spliced together. All loose, broken, or otherwise damaged line tie wires should be replaced, also missing tie wires.

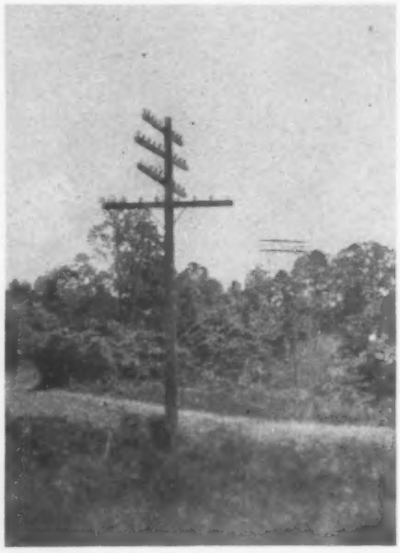
● Leakage between the wires of a rural lead is negligible if the circuits are clear of all objects and supported on good insulators. However, if the insulators are defective it may cause transmission loss during wet weather.

If the insulators are of glass or a thoroughly vitrified porcelain the leakage of current through the material of the insulator rarely occurs unless the insulators are cracked or otherwise damaged. Therefore, when discovered, all defective line wire insulators should be replaced.

Replaced insulators should be screwed down tight on the cross arm pin, or bracket and the line retied to the insulator with a new tie wire. When removed, damaged insulators should never be thrown on the road or nearby fields as they may cause injury to persons or animals. They should be placed in a suitable waste receptacle on the repairman's car for safe disposal.

● Trees are a constant source of interference to the satisfactory operation of rural lines, and preventive action should be taken before the trees actually come in contact with the line wire. In some cases the trees should be purchased and cut down as this eventually may prove cheaper than frequent trimming.

If property owners or state highway commission refuses to permit the trees to be cut down, then they should be properly trimmed, care being taken to avoid mutilation of the tree by correctly shaping the branches. However, effort should always be made to obtain as much clearance for the line as possible. A clearance of four or five feet is desirable if it is certain that it can be accomplished, by allowing for limbs growing



Line through timber with right-of-way cut eliminating tree trimming.

toward the line wires and cutting as far back as possible, without injury to the trees or the property owners feelings. Special attention should be given to over hanging limbs as they drop several feet when loaded with summer foliage or sleet and snow in Winter.

When a limb is removed from a tree the cut on the trunk should be properly treated with suitable paint to prevent decay.

● Vines and underbrush are important items to be considered. Vines grow near and climb poles entwining themselves around the line wires thus causing light grounds in dry weather and more heavy grounds in wet weather, these should be removed.

Property owners usually are glad to get rid of underbrush, and it should be removed before it grows up and becomes trees. However, it is always best to get the permission of the property owner before attempting to remove the brush.

After the brush is cut it should be carefully disposed of by either burning or hauling away.

After completion of work performed in connection with routine inspections and repairs, care should be taken to make sure that unused material or tools are not left lying on the ground or hanging overhead. Also, that no discarded material is left on private property or the highway which might result in complaints from property owners, motorist or pedestrians.

● In conclusion, it may be said that the importance of periodically scheduled routine inspection and repairs of rural telephone lines in their relation to satisfactory telephonic communication service to the public can hardly be underestimated.

Carter Named

E. F. Carter, vice-president, American Telephone & Telegraph Co., has accepted the chairmanship of the Communications Division in the United Hospital Campaign in New York, Edward R. Stettinius, Jr., chairman of the Commerce and Industry Committee has announced.

Service That Saves Lives

A night operator at Yuma, Ariz., recently answered a line signal from the plant of a local power company and connected the calling party with a Yuma doctor. Shortly after she had disconnected, the doctor called back asking where the call had come from as an injured man in need of immediate attention had neglected to say where he was. The operator told the doctor where the call originated, a service that was vital to life, as the doctor later explained the injured man had been caught in a machinery belt and was bleeding profusely when he arrived.

Gray Pay Station vs. Western Electric

Suit instituted against Western Electric by the Gray Telephone Pay Station Co., Hartford, Conn., will be heard in Chicago on February 10th. According to George A. Long, president of the Gray Company and plaintiff in the suit, other suits are being prepared against companies purchasing pay stations which Western Electric is now making and claimed as an infringement. Plaintiffs will depend on the court to obtain the necessary information as to those companies, providing of course, that Gray Company is successful. In two previous suits against the same company for infringements, the plaintiffs have been successful.

1937

BUYERS' GUIDE
and
DIRECTORY NUMBER

HOW TO USE THIS DIRECTORY

If you want to know the names of one or more manufacturers or jobbers making or selling a certain product, look in Section 1, where that product will appear in its proper place in the listing. For the complete name and address of any manufacturer or jobber look in Section 2. If you have the trade name of a product and want to know who manufactures it, look in Section 3, where trade names are alphabetically listed.

● The manufacturers and jobbers whose names are spotted throughout the listings advertise their products in this issue. Turn to Index to Advertisers, page 106, for the page on which you will find the advertising of any of these manufacturers and jobbers.

Editorial Section of

TELEPHONE ENGINEER
MANAGEMENT - ENGINEERING - MAINTENANCE

JANUARY, 1937
Chicago, Ill.

Telephone Engineer
1937 DIRECTORY NUMBER
● Section 1---PRODUCTS CLASSIFIED ●

ACCOUNTANTS AND AUDITORS
● Bowdle, F. A., Wheaton, Ill.
Coffey System & Audit Co., Indianapolis, Ind.
Engineering & Management Co., Lima, O.
● Herdrich & Boggs, Indianapolis, Ind.
● Larkin & Co., John C., Syracuse, N. Y.
● Russell, C. B., Columbus, O.

ADDING MACHINES
Burroughs Adding Machine Co., Detroit, Mich.
Felt & Tarrant Mfg. Co., Chicago, Ill.
Monroe Calculating Machine Co., Inc., Orange, N. J.
Remington Rand, Inc., Buffalo, N. Y.
Underwood Elliott Fisher Co., New York City.
Victor Adding Machine Co., Chicago, Ill.

ADDRESSING MACHINES
Addressograph-Multigraph Corp., Cleveland, O.
Elliott Addressing Machine Co., The, Cambridge, Mass.

ADVERTISING—DIRECTORY
Beatty Directory Co., Geo. F., St. Paul, Minn.
● Berry & Co., L. M., Dayton, O.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
Loomis Advertising Co., Kansas City, Mo.
Welker, J. H., Canton, O.

AERIAL CABLE RINGS
See Rings—Aerial Cable

AIR COMPRESSORS
● Albertson Electric Co., Milwaukee, Wis.
American Chain Co., Inc., Bridgeport, Conn.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
● Burning Brands Co., Chicago, Ill.
Cleveland Tractor Co., Cleveland, O.
Gardner-Denver Co., Quincy, Ill.
Homelite Corp., Port Chester, N. Y.
Schramm, Inc., Westchester, Pa.

AIR CONDITIONING SYSTEMS
● Albertson Electric Co., Milwaukee, Wis.
Betz Unit Air Cooler Co., Kansas City, Mo.
Carrier Engineering Co., Kansas City, Mo.
Curtiss Pneumatic Machinery Co., St. Louis, Mo.
● Graybar Electric Co., New York City.
Stephenson Engineering Co., Auburn, N. Y.
Trane Co., The, LaCrosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wing Mfg. Co., L. J., New York City.
Wood Industries, Inc., Gar, Detroit, Mich.

AIR FILTERS
● Burning Brands Co., Chicago, Ill.
● Albertson Electric Co., Milwaukee, Wis.

ALCOHOL TORCHES
See Torches—Self Acting, Alcohol

ALL-RELAY SWITCHBOARDS
See Switchboards—All-Relay

ALTERATION OF INSIDE AND OUTSIDE PLANT
National Trading & Construction Co., Chicago, Ill.

AMMETERS
See Electrical Instruments—Ammeters

AMPLIFIERS—TELEPHONE
● Communication Equipment & Engineering Co., Chicago, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

ANCHOR RODS
See Rods—Anchor

ANCHORS—CONCRETE
● American Automatic Electric Sales Co., Chicago, Ill
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Operadio Mfg. Co., St. Charles, Ill.
Rawlplug Co., Inc., The, New York City.
Star Expansion Bolt Co., New York City.

ANCHORS—FIBRE, FOR SCREWS
Rawlplug Co., The, New York City.

ANCHORS—GUY
● Aiken Anchor Co., St. Louis, Mo.
Alamo Iron Works, San Antonio, Tex.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Il.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Copperweld Co., Glassport, Pa.
Electroline Co., Chicago, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
Hubbard & Co., Pittsburgh, Pa.
Iron Products Corp., La Crosse, Wis.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
Specialty Device Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Weyerhaeuser Pole Co., Minneapolis, Minn.

ANCHORS—HAND DRIVEN
● Aiken Anchor Co., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

ANCHORS—RECLAIMABLE HYDRAULIC
● Aiken Anchor Co., St. Louis, Mo.

ANCHORS—SCREW
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.

● Advertisement in this issue—See Index to Advertisers, Page 106

● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
● Porcelain Products, Inc., Findlay, O.
Railroad Repair & Supply Co., Chicago, Ill.
Star Expansion Bolt Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

ANCHORS—TWIST

● Allen Electric Co., The Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

ANCHORS—WOOD

Meredith Co., Wm. C., Atlanta, Ga
National Lumber & Creosoting Co., Texarkana, Tex.
Niedermyer-Martin Lumber Co., Portland, Ore.
Standard Cedar Co., Minneapolis, Minn.
Texas Creosoting Co., Orange, Tex.
Wykoff Pipe & Creosoting Co., Inc., The, New York City.

ANNUNCIATORS

Couch Co., Inc., S. H., North Quincy, Mass.
Edwards & Co., New York City.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Stanley & Patterson, Inc., New York City.

APPRAISALS

See Engineers—Appraisal, Consulting, Valuation, Contracting

ARMS, BRACKETS AND HOLDERS—TELEPHONE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B. Centralia, Mo.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Hatheway-Patterson Corp., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Hubbard, A. N. Co., Pittsburgh, Pa.
Hurt & Co., Ferrum, Va.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
National Electric Products Corp., Pittsburgh, Pa.
● National Telephone Supply Co., The, Cleveland, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Vreeland, B. F., Denver Colo.
● Western Electric Co., New York City. (Distributed by Graybar)

ARRESTERS—LIGHTNING

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Illinois.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Communication Equipment & Engineering Co., Chicago, Ill.
● Cook Electric Co., Chicago, Ill.
General Electrical Co., Ltd., The, Coventry, England.
Hoppe Engineering Co., Indianapolis, Ind.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
National Electric Specialty Co., The, Toledo, O.
Porcelain Products, Inc., Findley, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Seeger Device Co., Toledo, O.
Shaw Insulator Co., Irvington, N. J.
Speer Carbon Co., St. Marys, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Sundt Engineering Co., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
● Graybar Electric Co., New York City.
Greenlee Bros. & Co., Rockford, Ill.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Railroad Repair & Supply Co., Chicago, Ill.
Snell Mfg. Co., Fiskdale, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

AUGERS—EARTH

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Fence & Wire Co., The, Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Coffing Hoist Co., Danville, Ill.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
Hydrauger Corp., Ltd., San Francisco, Calif.
● Iwan Bros., South Bend, Ind.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
Snell Mfg. Co., Fiskdale, Mass.
Specialty Device Co., The, Cincinnati, O.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

AUGERS—HYDRAULIC

Hydrauger Corp., San Francisco, Calif.

AUGERS—MASONRY

Hubbard & Co., Pittsburgh, Pa.

AUTOMANUAL SWITCHBOARDS

See Switchboards—Automanual

AUTOMATIC SWITCHBOARDS

See Switchboards—Automatic

AUTOMATIC TELEPHONES

See Telephones—Automatic

AXES AND HATCHETS—LINEMEN'S

American Fork & Hoe Co., The, Cleveland, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.

● Advertisement in this issue—See Index to Advertisers, Page 106

BAKELITE—LAMINATED

Splauding Fibre Co., Inc., Tonawanda, N. Y.
Synthane Corp., Oaks, Pa.

BAKELITE—MOLDED

Bakelite Corp., New York City.
Consolidated Molded Products Corp., Scranton, Pa.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Shaw Insulator Co., Irvington, N. J.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BAR—SOLDER

See Solder—Bar

BARS—CROW, DIGGING AND TAMPING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Line Material Co., South Milwaukee, Wis.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

BATTERIES—DRY CELLS

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bond Electric Corp., Jersey City, N. J.
Bright Star Battery Co., Clifton, N. J.
Burgess Battery Co., Freeport, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Edison, Inc., Thos. A., Bloomfield, N. J.
General Dry Batteries, Inc., Cleveland, O.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Hipwell Mfg. Co., N. S., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Le Carbone Co., Inc., Boonton, N. J.
● Leich Electric Co., Genoa, Ill.
Marathon Battery Co., Wausau, Wis.
● National Carbon Co., New York City.
● Ray-O-Vac Co., Madison, Wis.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Tele-Pak Co., The, St. Paul, Minn.
● Union Carbide & Carbon Co., New York City.
Union Electric Co., Indianapolis, Ind.

BATTERIES—PRIMARY

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Edison, Inc., Thos. A., Bloomfield, N. J.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Le Carbone Co., Inc., Boonton, N. J.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
Waterbury Battery Co., The, Waterbury, Conn.

BATTERIES—STORAGE

Allied Radio Corp., Chicago, Ill.
Alton Battery Co., Ltd., The, Alton Hants, England.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Beckman Mfg. Co., Lima, O.
Bond Electric Corp., Jersey City, N. J.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Edison, Inc., Thos. A., Bloomfield, N. J.
● Electric Storage Battery Co., Philadelphia, Pa.
● Gould Storage Battery Corp., Depew, N. Y.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Philadelphia Storage Battery Co., Philadelphia, Pa.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
Universal Battery Co., Chicago, Ill.
USL Battery Corp., Niagara Falls, N. Y.
Willard Storage Battery Co., Cleveland, O.

BATTERY CHARGING EQUIPMENT

Allied Radio Corp., Chicago, Ill.
● American Auomatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Electric Products Co., The, Cleveland, O.
● Fansteel Metallurgical Corp., North Chicago, Ill.
General Electric Co., Bridgeport, Conn.
General Electric Co., Ltd., The, Coventry, England.
● Gould Storage Battery Corp., Depew, N. Y.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Ideal Electric & Mfg. Co., The, Mansfield, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Pioneer Gen-E-Motor Corp., Chicago, Ill.
Schauer Machine Co., The, Cincinnati, O.
Screw Machine Products Corp., The, Providence, R. I.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
● Western Electric Co., New York City. (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BATTERY CLIPS

See Clips—Battery

BATTERY CONNECTORS

See Connectors—Battery

BATTERY ELIMINATORS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
B-L Electric Mfg. Co., St. Louis, Mo.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Carter Motor Co., Chicago, Ill.
● Gould Storage Battery Corp., Depew, N. Y.
● Leich Electric Co., Genoa, Ill.
Operadio Mfg. Co., St. Charles, Ill.
Pioneer Gen-E-Motor Corp., Chicago, Ill.
Schauer Machine Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BATTERY SWITCHES

See Switches—Battery

BATTERY WATER PURIFYING AND SOFTENING EQUIPMENT

See Water Purifying and Softener Equipment—Storage Battery

BELLS

● Albertson Electric Co., Milwaukee, Wis.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Edwards & Co., New York City.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Signal Engineering & Mfg. Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

BELTS AND SAFETY STRAPS—LINEMEN'S

● Allen Electric Co., The, Cleveland, O.
American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bashlin, Inc., W. M., Grove City, Pa.
Buckingham, W. H., Binghamton, N. Y.

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Buhrke Co., R. H., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Davis Emergency Equipment Co., New York City.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Mine Safety Appliance Co., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

BENCHES—MECHANICS' AND WORK

Angle Steel Stool Co., Inc., Plainwell, Mich.
Lyon Metal Products Inc., Aurora, Ill.

BINDING POSTS

● Brach Mfg. Corp, L. S., Newark, N. J.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Cook Electric Co., Chicago, Ill.
General Radio Co., Cambridge A, Mass.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Reliable Electric Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City. (Distributed by Graybar)

BLOCKS—CONNECTING

● Allen Electric Co., The, Cleveland, O.
● Cook Electric Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BLOCKS—FUSE

● Allen Electric Co., The, Cleveland, O.
● Brach Mfg. Corp., L. S., Newark, N. J.
● Cook Electric Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Littelfuse Laboratories, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., The, Cleveland, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City. (Distributed by Graybar)

BLOCKS—TACKLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Fence & Wire Co., The Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Western Block Co., Lockport, N. Y.

BLOCKS—TERMINAL

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BLOW TORCHES

See Torches—Gasoline-Blow; Also Torches—Kerosene-Blow

BLOWERS—VENTILATING

● Autovent Fan & Blower Co., Chicago, Ill.

BLUE PRINT EQUIPMENT

Globe-Wernicke Co., The, Cincinnati, O.
Milligan & Wright Co., Cleveland, O.
Pease Co., C. F., Chicago, Ill.

BOARDS—DISTRIBUTING

● Albertson Electric Co., Milwaukee, Wis.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BOARDS—POWER

● Albertson Electric Co., Milwaukee, Wis.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BOLT CLIPPERS

● Allen Electric Electric Co., the, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Forged Steel Products Co., Newport, Pa.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Porter Inc., H. K., Everett, Mass.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BOLTS—EXPANSION

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York City.
Star Expansion Bolt Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

BOLTS—TOGGLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Locke Insulator Corp., Baltimore, Md.
National Electric Products Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York City.
Star Expansion Bolt Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

BOLTS AND NUTS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Screw Co., Providence, R. I.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Burndy Engineering Co., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clark Bros. Bolt Co., Milldale, Conn.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.

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Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BOND WIRES AND PLATES

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brooklen Underground Electric Mfg. Co., Glenside, Pa.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Page Steel & Wire Div., American Chain Co., Inc., Bridgeport, Conn.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BOOKS—ON TELEPHONE SUBJECTS

● Telephone Engineer Publishing Co., Chicago, Ill.

BOOTH VENTILATORS—TELEPHONE

See Ventilators—Telephone Booth

BOOTHS—TELEPHONE PAY STATION

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Churchill Cabinet Co., Chicago, Ill.
Delta Manufacturing Company, Chicago, Ill.
● Graybar Electric Co., New Yory City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Sherron Metallic Corp., Brooklyn, N. Y.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Western Electric Co., New York City. (Distributed by Graybar)
Wilkinson Lumber Co., Allen A., Indianpolis, Ind.

BOXES—CABLE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cook Electric Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City. (Distributed by Graybar)

BOXES—COIL

● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.

BOXES—INSULATED BATTERY

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Paragon Electric Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

BOXES—TELEPHONE

Delta Manufacturing Co., Chicago, Ill.

BOXES—TERMINAL

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Churchill Cabinet Co., Chicago, Ill.
● Cook Electric Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Specialty Co., The, Toledo, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

BRACES—CROSS-ARM

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Carney & Co., B. J., Minneapolis, Minn.
● Chance, Co., A. B., Centralia, Mo.
Doubleday-Hill Electric Co., Pittsburgh, Pa.
● Graybar Electric Co., New York City.
Hallett Iron Works, Harvey, Ill.
Hatheway Patterson Corp., New York City.
Hubbard & Co., Pittsburgh, Pa.
Hughes Bros, Seward, Neb.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.
Wrought Washer Mfg. Co., Milwaukee, Wis.

BRACES—TRENCH

Duff-Norton Mfg. Co., The, Pittsburgh, Pa.

BRACKETS—CABLE RACK EXTENSION

Cleveland Trencher Co., The, Cleveland O.
Hallett Iron Works, Harvey, Ill.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Locke Insulator Corp., Baltimore, Md.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

BRACKETS—METAL

● Allen Electric Co., The, Cleveland, O.
● Buckeye Telephone & Supply Co., Columbus, O.
Doubleday-Hill Electric Co., Pittsburgh, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp, Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

BRACKETS—OAK INSULATOR

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Elkin Lumber & Mfg. Co., Elkin, N. C.
● Graybar Electric Co., New York City.
Hatheway Patterson Corp., New York City.
Hurt & Co., Ferrum, Va.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locust Pin Co., Inc., Front Royal, Va.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Port Royal Pin Mill, Port Royal, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Vreeland, B. F., Denver, Colo.

BRACKETS—PORCELAIN

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance, Co., A. B., Centralia, Mo.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
National Electric Products Corp., Pittsburgh, Pa.
● Pearl Co., Wm. H., Indianapolis, Ind.
Procelain Products, Inc., Parkersburg, W. Va.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Universal Specialty Co., Terre Haute, Ind.

BRACKETS—SIGN

● National Telephone Supply Co., Cleveland, O

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BRANDING EQUIPMENT

● Burning Brands Co., Chicago, Ill.

BRAZING TORCHES

See Torches—Brazing

BRIDLE RINGS

See Rings—Bridle

BRIDLE WIRE

See Wire—Bridle

BRUSHES—FOR MAGNETOS AND GENERATORS

● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Ideal Electric & Mfg. Co., The Mansfield, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Le Carbone Co., Inc., Boonton, N. J.
Screw Machine Products Corp., The, Providence, R. I.
Speer Carbon Co., St. Marys, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BRUSHES—CLEANING, DUSTING, PAINTING

Linzer & Sons, Inc., David, New York City.

BUFFERS

Chicago Wheel & Mfg. Co., Chicago, Ill.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Schauer Machine Co., The, Cincinnati, O.
● Wodack Electric Tool Corp., Chicago, Ill.

BUILDING MATERIAL—FOR EXCHANGES

Insulated Steel Construction Co., Middletown, O.

BURGLAR AND FIRE ALARM SYSTEMS

● Albertson Electric Co., Milwaukee, Wis.
Edwards & Co., New York City.
Gamewell Corp., The, Newton, Mass.
● Gould Storage Battery Corp., Depew, N. Y.
● Graybar Electric Co., New York City.
Guardian Electric Mfg. Co., Chicago, Ill.
Kidde & Co., Walter, Bloomfield, N. J.
Padua Hold-up Alarm Co., Cohoes, N. Y.
Signal Engineering & Mfg. Co., New York City.
Signaphone Corp., of America, New York City.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CABINETS—ALL KINDS

See Filing Cabinets; Also Lockers

CABINETS—TELEPHONE

● Albertson Electric Co., Milwaukee, Wis.
● Churchill Cabinet Co., Chicago, Ill.
Delta Manufacturing Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.

CABINETS—SWITCHBOARD

● Albertson Electric Co., Milwaukee, Wis.
● Churchill Cabinet Co., Chicago, Ill.
Delta Manufacturing Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CABLE—LEAD ENCASED

● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Cable Corp., New York City.
General Electric Co., Bridgeport, Conn.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of the Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co,. Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Pirelli General Cable Works, Ltd., Southampton, England.
Roebling's Sons Co., John A., Trenton, N. J.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

CABLE—OPEN ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.

CABLE—PAPER INSULATED

● American Automatic Electric Sales Co., Chicago, Ill.
American Electrical Works, Phillipsdale, R. I.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Cable Corp., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of The Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Pirelli General Cable Works, Ltd., Southampton, England.
Roebling's Sons Co., J. A., Trenton, N. J.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Eericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

CABLE—RUBBER COVERED

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of The Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Pirelli General Cable Works, Ltd., Southampton, England.
Roebling's Sons Co., John A., Trenton, N. J.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telekonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CABLE—SUBMARINE

● American Steel & Wire Co., Chicago, Ill.
● Communication Equipment & Engineering Co., Chicago, Ill.
● Graybar Electric Co., New York City.
National Electric Products Corp., Pittsburgh, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Simplex Wire & Cable Co., Boston, Mass.

CABLE—SWITCHBOARD

● American Automatic Electric Sales Co., Chicago, Ill.
American Electrical Works, Phillipsdale, R. I.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Pirelli General Cable Works, Ltd., Southampton, England.
Roebling's Sons Co., John A., Trenton, N. J.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

CABLE BENDERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Channell, J. W., Southgate, Calif.
● Everstick Anchor Co., The, Fairfield, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Utility Supply Co., Clintonville, Wis.

CABLE BOXES

See Boxes—Cable

● Advertisement in this issue—See Index to Advertisers, Page 106

CABLE CARS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Hallett Iron Works, Harvey, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CABLE CHAIRS

● Chance Co., A. B., Centralia, Mo.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CABLE CLAMPS

See Clamps—Cable

CABLE CLIPS

See Clips—Cable

CABLE COMPOUNDS

See Compounds—Cable and Pothead

CABLE CONNECTORS

See Connectors—Cable

CABLE DAMMING WAX

See Wax—Cable Damming

CABLE GRIPS

See Grips—Cable

CABLE HANGERS

See Hangers—Cable

CABLE PARAFFIN

See Paraffin—Cable

CABLE RACK EXTENSION BRACKETS

See Brackets—Cable Rack Extension

CABLE RACK INSERTS AND BOLTS

Cleveland Trencher Co., The, Cleveland, O.

CABLE RACKS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
British Insulated Cables, Ltd., Prescot Lancashire, England.
Brocklen Underground Electric Mfg. Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Four Wheel Drive Auto Co., Clintonville, Wis.
General Electric Co., Ltd., The, Coventry, England.
Hallett Iron Works, Harvey, Ill.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Metropolitan Device Corp., Brooklyn, N. Y.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Pirelli General Cable Works, Ltd., Southampton, England.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Western Electric Co., New York City. (Distributed by Graybar)

CABLE REEL CARRIERS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Hallet Iron Works, Harvey, Ill.
Highway Trailer Co., Edgerton, Wis.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Metropolitan Device Corp., Brooklyn, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Utilities Supply Co., Clintonville, Wis.
Utility Trailer Mfg. Co., Los Angeles, Calif.

CABLE REEL JACKS

See Jacks—Cable Reel

CABLE RINGS

See Rings—Cable

CABLE ROLLERS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancsashire, England.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Specialty Device Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CABLE SLEEVES

See Sleeves—Cable

CABLE SPLICERS' TENTS

See Tents—Cable Splicers'

CABLE SPLICING MACHINES

Channell, J. W., Southgate, Calif.
Kearney Corp., Jas. R., St. Louis, Mo.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CABLE TERMINALS

See Terminals—Cable

CABLE TESTERS

See Electrical Instruments—Cable Testers

CABLE TESTING EQUIPMENT—GAS

Air Reduction Sales Co., New York City.
Indiana Oxygen Co., Indianapolis, Ind.

CALCULAGRAPHS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Calculagraph Co., Harrison, N. J.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CALCULATING MACHINES

Burroughs Adding Machine Co., Detroit, Mich.
Marchant Calculating Machine Co., Oakland, Calif.

CANTHOOKS

● Allen Electric Co., The., Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

CARBOLINEUM

See Preservatives—Wood

CARBON—GRANULAR

General Electric Co., Ltd., The, Coventry, England.
Le Carbone Co., Inc., Boonton, N. J.
● Leich Electric Co., Genoa, Ill.
Noris Carbon Co., Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

CARRIER CURRENT EQUIPMENT

● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.

CEMENT CONDUIT

See Conduit—Cement

CHAIRS—OPERATOR

● American Automatic Electric Sales Co., Chicago, Ill.
Angle Steel Stool Co., Inc., Plainwell, Mich.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Burroughs Adding Machine Co., Detroit, Mich.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Do More Chair Co., Inc., Elkhart, Ind.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Heywood-Wakefield Co., Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Remington Rand, Inc., Buffalo, N. Y.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Sturgis Posture Chair Co., Sturgis, Mich.
● Western Electric Co., New York City. (Distributed by Graybar)

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CHESTNUT POLES

See Poles—Chestnut

CLAMPS—CABLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Frankel Connector Co., Inc., New York City.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Minerallac Electric Co., Chicago, Ill.
● National Telephone Supply Co., The, Cleveland, O.
Paine Co., Chicago, Ill.
Porcelain Products, Inc., Parkersburg, W. Va.
Railroad Repair & Supply Co., Chicago, Ill.
Reliable Electric Co., Chicago, Ill.
Roebling's Sons Co., J. A., Trenton, N. J.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.
Thomas & Sons Co., The R., Lisbon, O.

CLAMPS—DROP WIRE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburg, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CLAMPS—FUSE CLIP

Ideal Commutator Dresser Co., Sycamore, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CLAMPS—GROUND

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Blackburn Specialty Co., Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Mueller Electric Co., Cleveland, O.
● National Telephone Supply Co., Cleveland, O.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.
Thomas & Sons Co., The R., Lisbon, O.

CLAMPS—GUY

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Coffing Hoist Co., Danville, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., J. A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

CLAMPS—SPLICING

● Allen Electric Co., The, Cleveland, O.
Aluminum Co. of America, Pittsburgh, Pa.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Seeger Device Co., Toledo, O.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CLAMPS—STUBBING

Samson Mfg. Co., Centerville, Ia.

CLAMPS—TEST

See Clips and Clamps for Testing; Also Connectors

CLAY CONDUIT

See Conduit—Clay

CLEANERS—CONTACT

Electric Specialty Mfg. Co., Cedar Rapids, Ia.

CLEANING EQUIPMENT—SWITCHBOARD

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Breuer Electric Mfg. Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Curran Corp., The, Somerville, Mass.
Curtiss Pneumatic Machinery Co., St. Louis, Mo.
Electric Vacuum Cleaner Co., Inc., Cleveland, O.
Electrolux, Inc., New York City.
Eureka Vacuum Cleaner Co., Detroit, Mich.
Ideal Commutator Dresser Co., Sycamore, Ill.
Invincible Vacuum Cleaner Mfg. Co., Dover, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Peiffer, P., Newark, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CLIMBERS—LINEMEN'S

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Buckingham, W. H., Binghamton, N. Y.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Davis Emergency Equipment & Co., New York City.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CLIPS—BATTERY

Frankel Connectory Co., Inc., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Mueller Electric Co., Cleveland, O.
Railroad Repair & Supply Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

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CLIPS—CABLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales, Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Frankel Connector Co., Inc., New York City.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Mineralac Electric Co., Chicago, Ill.
● National Telephone Supply Co., The, Cleveland, O.
Pirelli General Cable Works, Ltd., Southampton, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CLIPS—FUSE

Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Littelfuse Laboratories, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CLIPS—WIRE ROPE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
● Matthews Corp., W. N., St. Louis, Mo.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CLIPS AND CLAMPS—TESTING

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Crescent Tool Co., Jamestown, N. Y.
Fahnestock Electric Co., Long Island City, N. Y.
Frankel Connector Co., Inc., New York City.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Mueller Electric Co., Cleveland, O.
● Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

COIL BOXES—

See Boxes—Coil

COIL TAPE

See Tape—Coil

COIL WINDERS

Four Wheel Drive Auto Co., Clintonville, Wis.
Ideal Commutator Dresser Co., Sycamore, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Shallcross Mfg. Co., Collingsdale, Pa.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

COILS—DUPLEXING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

COILS—INDUCTION

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City. (Distributed by Graybar)

COILS—LOADING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.

COILS—REPEATING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Engineering & Equipment Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City. (Distributed by Graybar)

COILS—RESISTANCE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Engineering & Equipment Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
Gray Instrument Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
● Shallcross Mfg. Co., Collingsdale, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
● Western Electric Co., New York City. (Distributed by Graybar)

COILS—REWOUND

● Buckeye Telephone & Supply Co., Columbus, O.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

COMMUTATOR GRINDERS

Ideal Commutator Dresser Co., Sycamore, Ill.

COMMUTATOR RESURFACERS

Ideal Commutator Dresser Co., Sycamore, Ill.

COMMUTATOR STONES

Electric Service Supplies Co., Philadelphia, Pa.
Ideal Commutator Dresser Co., Sycamore, Ill.

COMPOSITE RINGER SETS

See Ringer Sets—Composite

COMPOSITIONS—INSULATING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bakelite Corp., New York City.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Insulation Mfg. Co., Inc., Brooklyn, N. Y.
Mitchell-Rand Insulation Co., Inc., New York City.
Ruberoid Co., The, New York City.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Synthane Corp., Oaks, Pa.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
U. S. Rubber Co., New York City.

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COMPOUND TEMPERATURE REGISTERING INSTRUMENTS

See Temperometers—For Registering Temperatures of Compound, Paraffin, Solder, Wax

COMPOUNDS—CABLE, POTHEAD AND PULLING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cook's Sons, Inc., Adam, Linden, N. J.
General Electric Co., Bridgeport, Conn.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Minerallac Electric Co., Chicago, Ill.
Mitchell-Rand Insulation Co., Inc., New York City.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

COMPOUNDS—CABLE PULLING

See Compound, Cable, Pothead and Pulling

COMPOUNDS—PLASTIC AND LIQUID RUBBER

Barnard & Co., B. S., New York City.
Goodrich Co., The B. F., Akron, O.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.

COMPOUNDS—RUBBER

● Allen Electric Co., The, Cleveland, O.
Barnard & Co., B. S., New York City.
Goodrich Co., The B. F., Akron, O.
● Graybar Electric Co., New York City.
Johns-Manville, New York City.
Mitchell-Rand Insulation Co., Inc., New York City.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
U. S. Rubber Co., New York City.

COMPTOMETERS

Felt & Tarrant Mfg. Co., Chicago, Ill.

CONCRETE ANCHORS

See Anchors—Concrete

CONCRETE MIXERS

Brown Fence & Wire Co., The, Cleveland, O.
Leach Co., Oshkosh, Wis.
Smith Co., T. L., Milwaukee, Wis.

CONDENSERS

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bond Electric Corp., Jersey City, N. J.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Electric Specialty Co., The, Cresco, Ia.
● Fansteel Metallurgical Corp., North Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
General Radio Co., Cambridge, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.

CONDUIT—ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
National Electric Products Corp., Pittsburgh, Pa.

CONDUIT—ASBESTOS

Johns-Manville, New York City.

CONDUIT—CEMENT

Johns-Manville, New York City.
Metropolitan Device Corp., Brooklyn, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

CONDUIT—CLAY

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Brazil Hollow Brick & Tile Co., Brazil, Ind.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clay Products Co., Brazil, Ind.
● Graybar Electric Co., New York City.
Kaul Clay Mfg. Co., Toronto, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Fireproofing Corp., Pittsburgh, Pa.
Shawmut Clay Mfg. Co., St. Marys, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CONDUIT—CREOSOTED WOOD

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Gulf States Creosoting Co., Hattiesburg, Miss.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Meredith Co., Wm. C., Atlanta, Ga.
Neidermeyer-Martin Lumber Co., Portland, Ore.
Norfolk Creosoting Co., Norfolk, Va.
Pensacola Creosoting Co., Pensacola, Fla.
Southern Wood Preserving Co., Atlanta, Ga.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Vreeland, B. F., Denver, Colo.
Wycoff Pipe & Creosoting Co., Inc., The, New York City.

CONDUIT—FIBRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Co., Portland, Me.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Fibre Conduit Co., New York City.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CONDUIT—STEEL

● Kellogg Switchboard & Supply Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Steel & Tubes, Inc., Cleveland, O.

CONDUIT HANGERS

See Hangers—Conduit

CONDUIT INSTALLERS

Hirsch Organization, Gustav, Columbus, O.
National Engineering & Construction Co., Chicago, Ill.

CONDUIT RODS

See Rods—Conduit

CONDUIT TOOLS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleveland Trencher Co., The, Cleveland, O.
Cleverly Electrical Works, Ltd., Philadelphia, Pa.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Greenlee Bros. & Co., Rockford, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CONES—GROUND

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Specialty Co., Toledo, O.
Paragon Electric Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

CONNECTING BLOCKS

See Blocks—Connecting

● Advertisement in this issue—See Index to Advertisers, Page 106

CONNECTORS—BATTERY

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Electric Storage Battery Corp., The, Philadelphia, Pa.
Fahnestock Electric Co., Long Island City, N. Y.
● Gould Storage Battery Corp., Depew, N. Y.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Mueller Electric Co., Cleveland, O.
Railroad Repair & Supply Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Waterbury Battery Co., The, Waterbury, Conn.

CONNECTORS—CABLE

Crescent Tool Co., Jamestown, N. Y.
Frankel Connector Co., Inc., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
National Electric Products Corp., Pittsburgh, Pa.

CONNECTORS—WIRE-SOLDERLESS

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Burndy Engineering Co., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Electroline Co., Chicago, Ill.
Electric Specialty Mfg. Co., Cedar Rapids, Ia.
Frankel Connector Co., Inc., New York City.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Hubbard & Co., Pittsburgh, Pa.
Ideal Commutator Dresser Co., Sycamore, Ill.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
● Matthews Corp., W. N., St. Louis, Mo.
National Electric Products Corp., Pittsburgh, Pa.
● National Telephone Supply Co., Cleveland, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

CONSULTING ENGINEERS

See Engineers, Appraisal, Consulting, Valuation, Contracting

CONTACT CLEANERS

See Cleaners—Contact

CONTROL PANELS

See Panels—Control

CONVERTERS—D.C. to A.C.

Carter Motor Co., Chicago, Ill.
● Gould Storage Battery Corp., Depew, N. Y.
● Graybar Electric Co., New York City.
Pioneer Gen-E-Motor Corp., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS—RINGING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Electric Specialty Mfg. Co., Cedar Rapids, Ia.
General Electric Co., Ltd., The, Coventry, England.
● Gould Storage Battery Corp., Depew, N. Y.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Pioneer Gen-E-Motor Corp., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telephone Equipment Co., New York City.
● Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

CORDS—SWITCHBOARD AND TELEPHONE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
General Electric Co., Bridgeport, Conn.
● Independent Cord Co., Framingham, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
● Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Can.
● Runzel Cord & Wire Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

COUNTERS—SWITCHBOARD

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Veeder-Root, Inc., Hartford, Conn.
● Western Electric Co., New York City (Distributed by Graybar)

COVERS—DIRECTORY

Arnold Co., Milwaukee, Wis.
Barrett Bindery Co., The, Chicago, Ill.
Ft. Wayne Printing Co., Fort Wayne, Ind.

COVERS—MANHOLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cnance Co., A. B., Centralia, Mo.
Clow & Sons, James B., Chicago, Ill.
Hallett Iron Works, Harvey, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

COVERS—SWITCHBOARD

● Kellogg Switchboard & Supply Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.

CRANES

American Chain Co., Inc., Bridgeport, Conn.
American Hoist & Derrick Co., St. Paul, Minn.
Cleveland Tractor Co., The, Cleveland, O.
Trackson Co., Milwaukee, Wis.

CREOSOTE

See Preservatives—Wood

CREOSOTED WOOD CONDUIT

See Conduit—Creosoted Wood

CROSS-ARM BRACES

See Braces—Cross-Arm

CROSS-ARMS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Creosote Works, Inc., New Orleans, La.
American Cross-Arm, Inc., Jacksonville, Fla.
American Crossarm & Conduit Co., Chicago, Ill.
American Forest Products Co., Inc., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bond Bros., Birmingham, Ala.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Carney & Co., B. J., Minneapolis, Minn.
Cottage Planing Mill Co., Everett, Pa.
Doubleday-Hill Electric Co., Pittsburgh, Pa.
Douglas Fir Cross Arm Co., Denver, Colo.
Eppinger & Russell Co., New York City.
● Graybar Electric Co., New York City.
Gulfport Creosoting Co., Gulfport, Miss.
Gulf States Creosoting Co., Hattiesburg, Miss.

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Hatheway Patterson Corp., New York City.
Hubbard & Co., Pittsburgh, Pa.
Hughes Bros., Seward, Nebr.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwauke, Wis.
Long-Bell Lumber Sales Corp., Kansas City, Mo.
● Michigan Pole & Tie Co., Grand Rapids, Mich.
National Lumber & Creosoting Co., Texarkana, Tex.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Norfolk Creosoting Co., Norfolk, Pa.
Republic Creosoting Co., Indianpolis, Ind.
Pensacola Creosoting Co., Pensacola, Fla.
Seeger Device Co., Toledo, O.
Southern Wood Preserving Co., Atlanta, Ga.
Standard Cedar Co., Minneapolis, Minn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Texas Creosoting Co., Orange, Tex.
Union Electric Co., Indianapolis, Ind.
Vreeland, B. F., Denver, Colo.
Wood Preserving Corp., The, Pittsburgh, Pa.
Wyckoff Pipe & Creosoting Co., Inc., The, New York City.

CROSS-ARMS—TEMPORARY

● Coffing Hoist Co., Danville, Ill.

CROW BARS

See Bars—Crow, Digging and Tamping

CYPRESS POLES

See Poles—Cypress

DEADMEN—WOOD

● American Automatic Electric Sales Co., Chicago, Ill.
American Creosoting Co., Louisville, Ky.
American Forest Products Co., Inc., New York City.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Bell Lumber & Pole Co., Minneapolis, Minn.
Bond Bros., Birmingham, Ala.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Gulf States Creosoting Co., Hattiesburg, Miss.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Long-Bell Lumber Sales Corp., Kansas City, Mo.
● Michigan Pole & Tie Co., Grand Rapids, Mich.
National Lumber & Creosoting Co., Texarkana, Tex.
National Pole & Treating Co., Minneapolis, Minn.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Norfolk Creosoting Co., Norfolk, Va.
● Partridfie Lumber Co., T. M., Minneapolis, Minn.
Republic Creosoting Co., Indianapolis, Ind.
Standard Cedar Co., Minneapolis, Minn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Texas Creosoting Co., Orange, Tex.
● Valentine & Clark Corp., St. Paul, Minn.
Vreeland, B. F., Denver, Colo.
Wood Preserving Corp., The, Pittsburgh, Pa.
Weyerhaeuser Pole Co., Minneapolis, Minn.
Wyckoff Pie & Cresoting Co., Inc., The, New York City.

DIALS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgium, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● North Electric Mfg. Co., The, Galion, O.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Synthane Corp., Oaks, Pa.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

DIES—DRAWING AND STAMPING

Cleverly Electrical Works, Inc., Philadelphia, Pa.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Weber Bros. Mental Works, Chicago, Ill.
Wrought Washer Mfg. Co., Milwaukee, Wis.

DIES—BRANDING (STEEL)

● Burning Brands Co., Chicago, Ill.

DIGGERS—TRENCH

Barber-Greene Co., Aurora, Ill.
Cleveland Trencher Co., The, Cleveland, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
Gardner-Denver Co., Quincy, Ill.
● Graybar Electric Co., New York City.
Schramm, Inc., West Chester, Pa.
Utility Supply Co., Clintonville, Wis.

DIGGING BARS

See Bars—Crow, Digging and Tamping

DIGGING TOOLS—BARS, SPOONS, SHOVELS, SPUDS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwauke, Wis.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttie Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

DIRECTORY ADVERTISING SALES

See Advertising—Directory

DIRECTORY COVERS

See Covers—Directory

DIRECTORY PRINTING

See Printing—Directory

DIRECTORY PUBLISHING

See Publishing—Directory

DIVERTER POLE GENERATORS

Electric Products Co., The, Cleveland, O.

DISTRIBUTING BOARDS

See Boards—Distributing

DISTRIBUTING RINGS

See Rings—Distributing

DOUGLAS FIR POLES

See Poles—Douglas Fir

DRAFTING SUPPLIES

Kenffel & Esser Co., Hoboken, N. J.
Pease & Co., C. F., Chicago, Ill.
Tavella Sales Co., New York City.
Wright Inc., L. G., Cleveland, O.

DRAWING DIES

See Dies—Drawing and Stamping

DRILLS—ELECTRIC

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Black & Decker Mfg. Co., The, Towson, Md.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Millers Falls Co., Greenfield, Mass.
Railroad Repair & Supply Co., Chicago, Ill.
Schauer Machine Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Wodack Electric Tool Corp., Chicago, Ill.

DRILLS—HAND

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Hubbard & Co., Pittsburgh, Pa.
Millers Falls Co., Greenfield, Mass.
North Bros., Mfg. Co., Philadelphia, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Star Expansion Bolt Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

DRILLS—MASONRY

Gardner-Denver Co., Quincy, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Rawlplug Co., Inc., The, New York City.
● Wodack Electric Tool Corp., Chicago, Ill.

DRILLS—POLE HOLE

● Graybar Electric Co., New York City.
Schramm, Inc., West Chester, Pa.

DROP WIRE CLAMPS

See Clamps—Drop Wire

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DRY CELL BATTERIES
See Batteries—Dry Cell

DUPLEXING COILS
See Coils—Duplexing

DUPLICATING MACHINES
Beck Duplicator Co., The, New York City.

EARTH AUGERS
See Augers—Earth

ELECTRIC DRILLS
See Drills—Electric

ELECTRIC SOLDERING IRONS
See Soldering Irons—Electric

ELECTRIC TWINE
See Twine—Electric

ELECTRICAL CONTACT POINTS
Fansteel Metallurgical Corp., North Chicago, Ill.

ELECTRICAL INSTRUMENT REPAIR SERVICE
● Albertson Electric Co., Milwaukee, Wis.
Illinois Testing Laboratories, Inc., Chicago, Ill.
Gray Instrument Co., Philadelphia, Pa.
Railroad Repair & Supply Co., Chicago, Ill.

ELECTRICAL INSTRUMENTS—AMMETERS
● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Bristol Co., The, Waterbury, Conn.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
Screw Machine Products Corp., The, Providence, R. I.
● Shallcross Mfg. Co., Collingdale, Pa.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Measuring Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—ANEMOMETERS
Illinois Testing Laboratories, Inc., Chicago, Ill.
Roller-Smith Co., New York City.

ELECTRICAL INSTRUMENTS—CABLE TESTERS
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bristol Co., The, Waterbury, Conn.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Electric Specialty Mfg. Co., Cedar Rapids, Ia.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Gray Instrument Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
● Matthews Corp., W. N., St. Louis, Mo.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingsdale, Pa.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
● Stewart Bros., Ottawa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—GALVANOMETERS AND WHEATSTONE BRIDGES
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
General Radio Co., Cambridge A, Mass.
● Graybar Electric Co., New York City.
Gray Instrument Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Muter Co., The, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingdale, Pa.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
Sticht & Co., Herman H., New York City.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electric Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—GROUND TEST SETS
Biddle Co., James G., Philadelphia, Pa.
Electric Service Supplies Co., Philadelphia, Pa.
General Electric Co., Ltd., The, Coventry, England.
Gray Instrument Co., Philadelphia, Pa.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
● Stewart Bros., Ottawa, Ill.
Sticht & Co., Herman H., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—INSULATION TEST SETS
Automatique Electrique de Belgique, Antwerp, Belgium.
Biddle Co., James G., Philadelphia, Pa.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
Gray Instrument & Co., Philadelphia, Pa.
● Graybar Electric Co., New York City.
Leeds & Northrup Co., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingsdale, Pa.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
Sound Engineering Corp., Chicago, Ill.
Sticht & Co., Herman H., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M., Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—METERS
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Bristol Co., The, Waterbury, Conn.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City
● Shallcross Mfg. Co., Collingdale, Pa.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Weston Electrical Instrument Co., Newark, N. J.

ELECTRICAL INSTRUMENTS—PYOMETERS
Illinois Testing Laboratories, Inc., Chicago, Ill.
Roller-Smith Co., New York City.
Siemens Bros. & Co., Ltd., Woolwich, London, England.

ELECTRICAL INSTRUMENTS—SERVICE METERS
Babcock, Garrison, Seattle, Wash.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingsdale, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—SHUNTS AND MULTIPLIERS
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
International Resistance Co., Philadelphia, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
Seimens Bros. & Co., Ltd., Woolwich, London, England.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—TEST SETS (ALL KINDS)
● Allen Electric Co., The, Cleveland, Ohio.
Allied Radio Corp., Chicago, Ill.

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● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Electric Specialty Mfg. Co., Cedar Rapids, Ia.
General Electric Co., Ltd., The, Coventry, England.
Gray Instrument Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
Littelfuse Laboratories, Chicago, Ill.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingdale, Pa.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stewart Bros., Ottawa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Sundt Engineering Co., Chicago, Ill.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
● Western Electric Co., New York City. (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—TRANSMISSION TEST SETS

● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
● Shallcross Mfg. Co., Collingsdale, Pa.
Weston Electrical Instrument Corp., Newark, N. J.

ELECTRICAL INSTRUMENTS—VOLT METERS

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Bristol Co., The, Waterbury, Conn.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
Screw Machine Products Corp., The, Providence, R. I.
● Shallcross Mfg. Co., Collingdale, Pa.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.

EMPLOYES' INSURANCE

See Insurance—Employes', Liability and Fire

ENAMELED WIRE

See Wire—Enamel

ENAMELING

Burdick Enamel Sign Co., Chicago, Ill.
Ingram Richardson Mfg. Co., Beaver Falls, Pa.
● Suttle Equipment Co., Lawrenceville, Ill.

ENCLOSED FUSES

See Fuses—Enclosed

ENGINEERS—APPRAISAL, CONSULTING, VALUATION AND CONTRACTING

● Albertson Electric Co., Milwaukee, Wis.
American Appraisal Co., The, Milwaukee, Wis.
Babcock, Garrison, Seattle, Wash.
● Communication Equipment & Engineering Co., Chicago, Ill.
Cook, John M., Atlanta, Ga.
Engineering & Management Co., Lima, O.
Fowle & Co., Frank F., Chicago, Ill.
Hirsch Organization, Gustav, Columbus, O.
● Larkin & Co., John C., Syracuse, N. Y.
National Engineering & Construction Co., Chicago, Ill.
Read, Walter V., New York City.
Snook, Martin & Co., Columbus, O.
● Wopat, J. W., Ft. Wayne, Ind.
● Wray & Co., J. G., Chicago, Ill.

EXPANSION BOLTS

See Bolts—Expansion

EXTENSION BELL RINGERS

See Ringers—Extension Bell

EXTENSION PLUGS AND JACKS

See Plugs and Jacks—Extension

EXTENSION RELAYS

See Relays—Extension

FANS—ELECTRIC FOR SWITCHBOARD ROOMS

● American Automatic Electric Sales Co., Chicago, Ill.
Gaylord Mfg. Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

FANS—PROPELLER

● Autovent Fan & Blower Co., Chicago, Ill.

FIBRE CONDUIT

See Conduit—Fibre

FIBRE TEST BOARDS—SPLICERS'

● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.

FILING CABINETS

All-Steel Equipment Co., Aurora, Ill.
Angle Steel Stool Co., Inc., Plainwell, Mich.
Art Metal Construction Co., Jamestown, N. Y.
Durabilt Steel Locker Co., Aurora, Ill.
Globe-Wernicke Co., The, Norwood, Cincinnati, (
Lyon Metal Products, Inc., Aurora, Ill.
Remington Rand, Inc., Buffalo, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Warren Mfg. Co., J. D., Montpelier, O.
Yawman & Erbe Mfg. Co., Rochester, N. Y.

FINANCING—TELEPHONE

● Baker, Walsh Co., Chicago, Ill.
Bonbright & Co., New York City.
MacDonald & Co., T. L., New York Cit
Webber-Simpson Co., Chicago, Ill.
● Wray & Co., J. G., Chicago, Ill.

FIRE ALARM SYSTEMS

See Burglar and Fire Alarm Systems

FIRE EXTINGUISHING EQUIPMENT—PORTABLE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
C-O-Two Fire Equipment Co., Newark, N. J.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kidde & Co., Inc., Walter, Bloomfield, N. J.
Pyrene Mfg. Co., Newark, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

FIRE EXTINGUISHING SYSTEMS

C-O-Two Fire Equipment Co., Newark, N. J.
Kidde & Co., Inc., Walter, Bloomfield, N. J.
Pyrene Mfg. Co., Newark, N. J.

FIRE INSURANCE

See Insurance—Employes', Liability and Fire

FIRE POTS AND FURNACES

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Bernz Co., Inc., Otto, Rochester, N. Y.
Brown Fence & Wire Co., The, Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clayton & Lambert Mfg. Co., Detroit, Mich.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Red Devil Mfg. Co., Bellwood, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Turner Brass Works, The, Sycamore, Ill.
Van Praag Sales Corp., New York City.
● Unique Mfg. Co., Chicago, Ill.
Wall Mfg. Supply Co., P., Pittsburgh, Pa.

FLAGS AND FLAGHOLDERS

● Coffing Hoist Co., Danville, Ill.
Barnard & Co., B. S., New York City.
Leach Co., Oshkosh, Wis.

FLAMEPROOF JUMPER WIRE

See Wire—Flameproof Jumper

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FLASHLIGHTS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Bond Electric Corp., Jersey City, N. J.
Bright Star Battery Co., Clifton, N. J.
Burgess Battery Co., Freeport, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Davis Emergency Equipment Co., Inc., New York City.
● Graybar Electric Co., New York City.
Hipwell Mfg. Co., N. S., Pittsburgh, Pa.
Mine Safety Appliances Co., Pittsburgh, Pa.
● National Carbon Co., New York City.
● Ray-O-Vac Co., Madison, Wis.
● Union Carbide & Carbon Co., New York City.

FLEXIBLE SHAFT MACHINERY

Haskins Co., R. G., Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.

FLUX—ALUMINUM

Air Reduction Sales Co., New York City.
Linde Air Products Co., The, New York City.

FLUX—SOLDERING

Air Reduction Sales Co., New York City.
● Allen Co., L. B., Chicago, Ill.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
Brooklen Underground Electric Mfg. Co., Glenside, Pa.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dunton Co., The M. W., Providence, R. I.
General Electric Co., Bridgeport, Conn.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Kester Solder Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Mitchell-Rand Insulation Co., Inc., New York City
Pirelli General Cable Works, Ltd., Southampton, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Van Cleef Bros., Chicago, Ill.
Union Electric Co., Indianapolis, Ind.
Williams, Mfr., Geo. E., Minneapolis, Minn.

FRAMELESS STEEL EXCHANGE BUILDINGS

Insulated Steel Construction Co., Middletown, O.

FRICTION TAPE

See Tape—Friction

FURNACES

See Fire Pots and Furnaces

FUSE BLOCKS

See Blocks—Fuse

FUSE CLIP CLAMPS

See Clamps—Fuse Clip

FUSE LINKS

See Fuses—Line and Mica

FUSE STRIPS

See Blocks—Fuse

FUSE WIRE

See Wire—Fuse

FUSES ENCLOSED

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Cook Electric Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwauke, Wis.
Littlefuse Laboratories, Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

FUSES—GLASS

Littelfuse Laboratories, Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.

FUSES—LINE AND MICA

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cook Electric Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
National Electric Specialty Co., The, Toledo, O.
● Reliable Electric Co., Chicago, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

GAINS—METAL

● Allen Electric Co., The, Cleveland, O.
Hallett Iron Works, Harvey, Ill.
Hubbard & Co., Pittsburgh, Pa.
● Leich Electric Co., Genoa, Ill.

GALVANIZING

● Cnance Co., A. B., Centralia, Mo.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
● The National Telephone Supply Co., Cleveland, O.
Oliver Iron & Steel Corp., Pittsburgh, Pa.

GALVANOMETERS AND WHEATSTONE BRIDGES

See Electrical Instruments—Galvanometers and Wheatstone Bridges

GASOLINE TORCHES

See Torches—Gasoline, Blow

GAUGES—LINEMEN'S SPUR

● Blackburn Products Corp., Jasper, St. Louis, Mo.

GLASS FUSES

See Fuses—Glass

GLASS INSULATORS

See Insulators—Glass

GLOVES—LINEMEN'S

● Allen Electric Co., The, Cleveland, O.
American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Goodrich Co., The B. F., Akron, O.
● Graybar Electric Co., New York City.
Line Material Co., South Milwaukee, Wis.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Mathias-Hart Co., Ampere, N. J.
Mine Safety Appliances Co., Pittsburgh, Pa.
Parker Bros. & Co., Littleton, N. H.
Railroad Repair & Supply Co., Chicago, Ill.
Salisbury & Co., W. H., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

GRANULAR CARBON

See Carbon—Granular

GRINDERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Bakelite Corp., New York City.
Black & Decker Mfg. Co., The, Towson, Md.
Chicago Wheel & Mfg. Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Railroad Repair & Supply Co., Chicago, Ill.
Schauer Machine Co., The, Cincinnati, O.
● Wodack Electric Tool Corp., Chicago, Ill.

GRIPS—CABLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.

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● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Kellems Products, Inc., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

GRIPS—WIRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., Jas. R., St. Louis, Mo.
Kellems Products, Inc., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

GROUND CLAMPS

See Clamps—Ground

GROUND CONES

See Cones—Ground

GROUND RODS

See Rods—Ground

GROUND TEST SETS

See Electrical Instruments—Ground Test Sets

GUARDS—GUY WIRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Hughes Bros., Seward, Neb.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
● Matthews Corp., W. N., St. Louis, Mo.
Meredith Co., Wm. C., Atlanta, Ga.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Specialty Device Co., The, Cincinnati, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

GUARDS—TREE WIRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Meredith Co., Wm. C., Atlanta, Ga.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

GUY ANCHORS

See Anchors—Guy

GUY CLAMPS

See Clamps—Guy

GUY RODS

See Rods—Guy

GUY WIRE GUARDS

See Guards—Guy Wire

HAMMERS

American Fork & Hoe Co., The, Cleveland, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.

HAMMERS—ELECTRIC

● Wodack Electric Tool Corp., Chicago, Ill.

HAND DRILLS

See Drills—Hand

HAND LINES

● Klein & Sons, Mathias, Chicago, Ill.

HANGERS—CABLE

● The National Telephone Supply Co., Cleveland, O.

HANGERS—CONDUIT

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Minerallac Electric Co., Chicago, Ill.
Paine Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

HANGERS—MESSENGER

● The National Telephone Supply Co., Cleveland, O.

HEAD BANDS—RECEIVER

● American Automatic Electric Sales C., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

HEATER UNITS—STEAM or ELECTRIC

● Autovent Fan & Blower Co., Chicago, Ill.

HOISTS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Chain Co., Inc., Bridgeport, Conn.
American Hoist & Derrick Co., St. Paul, Minn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Blackburn Products Corp., Jasper, St. Louis, Mo.
Brown Fence & Wire Co., The, Cleveland, O.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Coffing Hoist Co., Danville, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Joyce-Cridland Co., The, New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Utility Supply Co., Clintonville, Wis.
Wood Industries, Inc., Gar, Detroit, Mich.
Yale & Towne Mfg. Co., The, Philadelphia, Pa.

HOLDERS—BATTERY

General Electric Co., Ltd., The, Coventry, England.
● Gould Storage Battery Corp., Depew, N. Y.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Paragon Electric Co., Chicago, Ill.

HOLDERS—TELEPHONE

See Arms, Brackets and Holders—Telephone

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HORNS AND SIGNALS

● Allen Electrical Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
Edwards & Co., New York City.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Operadio Mfg. Co., St. Charles, Ill.
Padua Hold-up Alarm Co., Inc., Cohoes, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Signal Engineering & Mfg. Co., New York City.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

HYDRAULIC AUGURS

See Augers—Hydraulic

INDEX CARD SYSTEMS—COMPLETE TELEPHONE

Acme Card Systems Co., Chicago, Ill.
Bates Mfg. Co., New York City.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
Globe-Wernicke Co., The, Norwood, Cincinnati, O.
Remington Rand, Inc., Buffalo, N. Y.
Yawman & Erbe Mfg. Co., Rochester, N. Y.

INDICATORS—TENSION

Automatique Electrique de Belgique, Antwerp, Belgium.
Chatillon & Sons, John, New York City.
General Electric Co., Ltd., The, Coventry, England.
Martin-Decker Corp., Long Beach, Calif.
Sundt Engineering Co., Chicago, Ill.

INDUCTION COILS

See Coils—Induction

INSULATED BATTERY BOXES

See Boxes—Insulated Battery

INSULATED DROP BRONZE WIRE

See Wire—Insulated Drop Bronze

INSULATED DROP COPPER WIRE

See Wire—Insulated Drop Copper

INSULATED DROP COPPERWELD WIRE

See Wire—Insulated Drop Copperweld

INSULATED DROP IRON WIRE

See Wire—Insulated Drop Iron

INSULATED NAILS

See Nails—Insulated

INSULATED STAPLES

See Staples—Insulated

INSULATED TACKS

See Tacks—Insulated

INSULATING COMPOSITIONS

See Compositions—Insulating

INSULATING TAPE

See Tape—Insulating

INSULATION—MOLDED

Bakelite Corp., New York City.
Barnard & Co., B. S., New York City.
British Insulated Cables, Inc., Prescot, Lancashire, England.
● Graybar Electric Co., New York City.
Johns-Manville, New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Synthane Corp., Oaks, Pa.
Synthetic Mould Products, Inc., Stonington, Conn.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.

INSULATION TEST SETS

See Electrical Instruments—Insulating Test Sets

INSULATORS—GLASS

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Corning Glass Works, Corning, N. Y.
● Graybar Electric Co., New York City.
Hatheway Patterson Corp., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
● Owens-Illinois Glass Co., Hemingway Div., Muncie, Ind.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.
Whitall Tatum Co., New York City.

INSULATORS—MOLDED RUBBER

Goodrich Co., The B. F., Akron, O.

INSULATORS—PORCELAIN

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
National Electric Products Corp., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Porcelain Products, Inc., Findlay, O.
Porcelain Products, Inc., Parkersburg, W. Va.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Thomas & Sons Co., The R., Lisbon, O.
Union Electric Co., Indianapolis, Ind.
Universal Specialty Co., Terre Haute, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSURANCE—EMPLOYES', LIABILITY AND FIRE

Block & Co., Lynton T., St. Louis, Mo.
Liberty Mutual Insurance Co., Boston, Mass.

INTERCOMMUNICATING TELEPHONES

See Telephones—Intercommunicating

INTERIOR WIRE

See Wire—Interior

JACKS—CABLE REEL

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Chain Co., Inc., Bridgeport, Conn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
British Insulated Cables, Inc., Prescot, Lancashire, England.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Duff-Norton Mfg. Co., The, Pittsburgh, Pa.
● Graybar Electric Co., New York City.
Hallet Iron Works, Harvey, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

JACKS—POLE

● Coffing Hoist Co., Danville, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

KNIFE SWITCHES

See Switches—Knife

KNIVES—LINEMEN'S AND ELECTRICIANS'

● Klein & Sons, Mathias, Chicago, Ill.
Buckingham, W. H., Binghamton, N. Y.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

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KNOBS AND CLEATS—PORCELAIN

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Wire & Associated Corp., Chicago, Ill.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Porcelain Products, Inc., Findlay, O.
Porcelain Products, Inc., Parkersburg, W. Va.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Thomas & Sons Co., The R., Lisbon, O.
Union Electric Co., Indianapolis, Ind.
Universal Specialty Co., Terre Haute, Ind.

LADDER MOUNTS

American Allsafe Co., Buffalo, N. Y.
Davis Emergency Equipment Co., Inc., New York City.
Electric Service Supplies Co., Philadelphia, Pa.

LADDERS

● Allen Electric Co., The, Cleveland, O.
American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Coach & Body Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Calander Mfg. Co., St. Paul, Minn.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Duo-Safety Ladder Corp., Oshkosh, Wis.
Electric Service Supplies Co., Philadelphia, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Locke Insulator Corp., Baltimore, Md.
Metropolitan Device Corp., Brooklyn, N. Y.
Putnam & Co., Inc., New York City.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.
Warren Mfg. Co., J. D., Montpelier, O.

LADLES—POURING

Barnard & Co., B. S., New York City.
● Burning Brands Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Struthers Dunn, Inc., Philadelphia, Pa.
Turner Brass Works, The, Sycamore, Ill.
● Unique Mfg. Co., Chicago, Ill.
Williams, Mfg., Geo. E., Minneapolis, Minn.

LAG SCREWS

See Screws—Lag

LAMPS—SWITCHBOARD AND MINIATURE

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Hygrade Sylvania Corp., Salem, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Littelfuse Laboratories, Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LATHES

South Bend Lathe Works, South Bend, Ind.

LEAD ENCASED CABLE

See Cables—Lead Encased

LEAD SLEEVES

See Sleeves—Lead

LIABILITY INSURANCE

See Insurance—Employes' Liability and Fire

LIGHTING EMERGENCY BATTERY SYSTEMS

● Electric Storage Battery Co., The, Philadelphia, Pa.
● Gould Storage Battery Corp., Depew, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LIGHTNING ARRESTERS

See Arresters—Lightning

LINE AND MICA FUSES

See Fuses—Line and Mica

LINEMEN'S AXES AND HATCHETS

See Axes and Hatchets—Linemen's

LINEMEN'S BELTS AND SAFETY STRAPS

See Belts and Safety Straps—Linemen's

LINEMEN'S CLIMBERS

See Climbers—Linemen's

LINEMEN'S GLOVES

See Gloves—Linemen's

LINEMEN'S WEED CUTTING EQUIPMENT

See Weed Cutting Equipment—Linemen's

LOAD BINDERS

● Coffing Hoist Co., Danville, Ill.
Leach Co., Oshkosh, Wis.

LOADING COILS

See Coils—Loading

LOCKERS

All-Steel Equipment Co., Aurora, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
Angle Steel Tool Co., Inc., Plainwell, Mich.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Durabilt Steel Locker Co., Aurora, Ill.
Electric Service Supplies Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Lyon Metal Products, Inc., Aurora, Ill.
Medart Mfg. Co., Fred, St. Louis, Mo.
Tuttle & Bailey, Inc., New Britain, Conn.

LOCK-OUT AND SELECTIVE TELEPHONES

See Telephones—Lock-Out and Selective

LODGEPOLE PINE POLES

See Poles—Lodge Pole Pine

MAGNET WIRE

See Wire—Magnet

MAGNETO AND GENERATOR BRUSHES

See Brushes—Magneto and Generator

MAGNETO SWITCHBOARDS

See Switchboards—Magneto

MAGNETO TELEPHONES

See Telephones—Magneto

MAIN FRAMES

● Cook Electric Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.

MANHOLE COVERS

See Covers—Manhole

MANHOLE FORMS

● Chance Co., A. B., Centralia, Mo.
Cleveland Trencher Co., The, Cleveland, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Star Bit & Tool Co., Rockford, Ill.

MANHOLE FRAMES

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Clow & Sons, James B., Chicago, Ill.
Hallett Iron Works, Harvey, Ill.

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● Kellogg Switchboard & Supply Co., Chicago, Ill.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

MANHOLE GUARDS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Hallett Iron Works, Harvey, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Seeger Device Co., Toledo, O.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Toledo Pressed Steel Co., The, Toledo, O.

MANHOLE PUMPS

Homelite Corp., Port Chester, N. Y.
Novo Engine Co., Lansing, Mich.

MANUAL SWITCHBOARDS

See Switchboards—Manual

MANUAL TELEPHONES

See Telephones—Manual

MASONRY AUGERS

See Augers—Masonry

MASONRY DRILLS

See Drills—Masonry

MELTING POTS

See Pots—Melting

MESSENGER AND GUY STRAND

See Strand—Messenger and Guy

MESSENGER TENSION TESTING INSTRUMENTS

● Kellogg Switchboard & Supply Co., Chicago, Ill.
Tinius Olsen Testing Machine Co., Philadelphia, Pa.

METAL BRACKETS

See Brackets—Metal

METAL GAINS

See Gains— Metal

METERS

See Electrical Instruments—Meters

MICROSCOPES

Spencer Lens Co., Buffalo, N. Y.

MIMEOGRAPH EQUIPMENT

Dick Co., A. B., Chicago, Ill.

MOLDED BAKELITE

See Bakelite—Molded

MOLDED INSULATION

See Insulation—Molded

MOLDED RUBBER INSULATORS

See Insulators—Molded Rubber

MOTOR GENERATORS—BATTERY CHARGING AND RINGING

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Electric Products Co., The, Cleveland, O.
General Electric Co., Ltd., The, Coventry, England.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Ideal Electric Co., The, Mansfield, O.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Pioneer Gen-E-Motor Corp., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTOR TRUCKS

Brockway Motor Co., Inc., Cortland, N. Y.
Chevrolet Motor Co., Detroit, Mich.
Consolidated Motors Corp., Lima, O.
Dodge Brothers, Detroit, Mich.
Federal Motor Truck Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
General Motors Truck Co., Detroit, Mich.
● Graybar Electric Co., New York City.
International Harvester Co. of America, Chicago, Ill.
Mack Trucks, Inc., New York City.
Reo Motor Car Co., Lansing, Mich.
S. P. A. Truck Corp., South Bend, Ind.
Utility Supply Co., Clintonville, Wis.
White Co., The, Cleveland, O.

MOUTH PIECES

● American Automatic Electric Sales Co., Chicago, Ill.
American Record Corp., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

NAILS

● American Steel & Wire Co., Chicago, Ill.
Angell Nail & Chaplet Co., The, Cleveland, O.
Copperweld Co., Glassport, Pa.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Keystone Steel & Wire Co., Peoria, Ill.

NAILS—INSULATED

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Morley Button Mfg. Co., Portsmouth, N. H.
Rhodes & Sons Co., M. M., Taunton, Mass.
Union Electric Co., Indianapolis, Ind.

NAILS—WIRING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Emerson Apparatus Co., Melrose, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Morley Button Mfg. Co., Portsmouth, N. H.
Rhodes & Sons Co., M. M., Taunton, Mass.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

NICKEL PLATING

● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.

NITROGEN—DRY

Air Reduction Sales Co., New York City.
Indiana Oxygen Co., Indianapolis, Ind.
Linde Air Products Co., The, New York City.

NORTHERN WHITE CEDAR POLES

See Poles—Northern White Cedar

OAK INSULATOR BRACKETS

See Brackets—Oak Insulator

OFFICE FURNITURE AND SUPPLIES

● American Automatic Electric Sales Co., Chicago, Ill.
Angle Steel Stool Co., Inc., Plainwell, Mich.
Art Metal Construction Co., Jamestown, N. Y.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Do More Chair Co., Elkhart, Ind.
General Office Equipment, New York City.
Globe-Wernicke Co., The, Norwood, Cincinnati, O.
Lyon Metal Products, Inc., Aurora, Ill.
Remington Rand, Inc., Buffalo, N. Y.
Schollhorn Co., The Wm., New Haven, Conn.
● Sturgis Posture Chair Co., Sturgis, Mich.
Yawman & Erbe Mfg. Co., Rochester, N. Y.

OPEN ALUMINUM CABLE

See Cable—Open Aluminum

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OPEN COPPERWELD WIRE
See Wire—Open Copperweld

OPEN GALVANIZED STEEL WIRE
See Wire—Open Galvanized Steel

OPEN HARD DRAWN COPPER WIRE
See Wire—Open Hard Drawn Copper

OPERATORS' CHAIRS
See Chairs—Operators'

OPERATORS' RECEIVERS
See Receivers—Operators'

OPERATORS' SUPERVISOR SETS
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Western Electric Co., New York City (Distributed by Graybar)

OUTDOOR AND MINE TELEPHONES
See Telephones—Outdoor and Mine

OXY-ACETYLENE TORCHES
See Torches—Oxy-Acetylene

PAGING SYSTEMS
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
Amplified Products Co., Redondo Beach, Calif.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
Edwards & Co., Inc., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● North Electric Mfg. Co., The, Galion, O.
Operadio Mfg. Co., St. Charles, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Signal Engineering & Mfg. Co., New York City.
Stanley & Patterson, Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

PAINT—SPRAY GUNS
● Burning Brands Co., Chicago, Ill.

PANELS—BAKELITE
Synthane Corp., Oaks, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PANELS—CONTROL
● Communication Equipment & Engineering Co., Chicago, Ill.
● Electric Products Co., The, Cleveland, O.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Roller-Smith Co., New York City.
Signal Engineering & Mfg. Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PAPER INSULATED CABLE
See Cable—Paper Insulated

PAPER SLEEVES
See Sleeves—Paper

PARAFFIN—CABLE
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cook's Sons, Inc., Adam, Linden, N. J.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Mitchell-Rand Insulation Co., Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

PARAFFIN TEMPERATURE REGISTERING INSTRUMENTS
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Dillon Mfg. Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

PARTITIONS—STEEL and WOOD
Globe-Wernicke Co., The, Cincinnati, O.

PAY-OUT AND TAKE-UP REELS
See Reels—Pay-Out and Take-Up

PAY STATION TELEPHONES
See Telephones—Pay Station

P. B. X. SWITCHBOARDS
See Switchboards—P. B. X.

PIKE POLES
American Fork & Hoe Co., The Cleveland, O.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Railroad Repair & Supply Co., Chicago, Ill.

PINS AND BRACKETS
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
American Cross-Arm, Inc., Jacksonville, Fla.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cottage Planing Mill Co., Everett, Pa.
Douglas Fir Cross Arm Co., Denver, Colo.
Elkin Lumber & Mfg. Co., Elkin, N. C.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Hurt & Co., Ferrum, Va.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Locust Pin Co., Inc., Front Royal, Va.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Porcelain Products, Inc., Findlay, O.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.
Vreeland, B. F., Denver, Colo.

PIPE BENDERS
Greenlee Bros. & Co., Rockford, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.

PIPE CAPS
● Allen Electric Co., The, Cleveland, O.
Clow & Sons, James B., Chicago, Ill.
Hubbard & Co., Pittsburgh, Pa.

PIPE PUSHERS
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Duff-Norton Mfg. Co., The, Pittsburgh, Pa.
● Graybar Electric Co., New York City.
Greenlee Bros. & Co., Rockford, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Seeger Device Co., Toledo, O.

PLIERS AND WIRE CUTTERS
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Brown Fence & Wire Co., The, Cleveland, O.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
Davis Emergency Equipment Co., New York City.
● Forged Steel Products Co., Newport, Pa.
● Graybar Electric Co., New York City.
Grobet File Corp. of America, New York City.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
Kraeuter & Co., Newark, N. J.
● Leich Electric Co., Genoa, Ill.
Porter, Inc., H. K., Everett, Mass.

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Railroad Repair & Supply Co., Chicago, Ill.
Schollhorn Co., The Wm., New Haven, Conn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

PLUGS—SWITCHBOARD

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Electric Specialty Mfg. Co., Cedar Rapids, Mich.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Runzel Cord & Wire Co., Chicago, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.

PLUGS AND JACKS—EXTENSION

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

POLE CHANGERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

POLE ERECTORS and DERRICKS

Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
Trackson Co., Milwaukee, Wis.
Utility Supply Co., Clintonville, Wis.
Wood Industries, Inc., Gar, Detroit, Mich.

POLE HEIGHT ESTIMATORS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Blackburn Products Corp., Jasper, St. Louis, Mo.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Kearney Corp., Jas. R., St. Louis, Mo.
● Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
Union Electric Co., Indianapolis, Ind.

POLE HOLE DIGGERS—HAND

● American Automatic Electric Sales Co., Chicago, Ill.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Fence & Wire Co., The, Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
● Everstick Anchor Co., The, Fairfield, Ia.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Iwan Bros., South Bend, Ind.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
● Leich Electric Co., Genoa, Ill.
Railroad Repair and Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

POLE HOLE DIGGERS—POWER

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Buda Co., The, Harvey, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleveland Tractor Co., The, Cleveland, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
Trackson Co., Milwaukee, Wis.
Utility Supply Co., Clintonville, Wis.

POLE IDENTIFICATION TAGS

● Allen Electric Co., The, Cleveland, O.
Aluminum Co. of America, Pittsburgh, Pa.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Matthews & Co., Jas. H., Pittsburgh, Pa.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
● Premax Sales Div., Chisholm-Ryder Co., Inc., Niagara Falls, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.

POLE JACKS

See Jacks—Pole

POLE LINE HARDWARE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Cross-Arm, Inc., Jacksonville, Fla.
American Hoist & Derrick Co., St. Paul, Minn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Gravely, B. F. and R. P., Martinsville, Va.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Lanz Bolt Co., M., Pittsburgh, Pa.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
National Electric Products Corp., Pittsburgh, Pa.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
● Porcelain Products, Inc., Findlay, O.
Railroad Repair and Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.
Wrought Washer Mfg. Co., Milwaukee, Wis.

POLE PUSHERS

Harrah Mfg. Co., Bloomfield, Ind.
● Kellogg Switchboard & Supply Co., Chicago, Ill.

POLE REINFORCING EQUIPMENT

● Allen Electric Co., The, Cleveland, O.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
● National Telephone Supply Co., The Cleveland, O.
Oliver Iron & Steel Corp., Pittsburgh, Pa.

POLE SEATS, BALCONIES, PLATFORMS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hallett Iron Works, Harvey, Ill.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Locke Insulator Corp., Baltimore, Md.
Star Bit & Tool Co., Rockford, Ill.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

POLE STEPS

● American Automatic Electric Sales Co., Chicago, Ill.
American Crossarm & Conduit Co., Chicago, Ill.
American Cross-Arm, Inc., Jacksonville, Fla.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.

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● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Elkin Lumber & Mfg. Co., Elkin, N. C.
● Graybar Electric Co., New York City.
Hatheway Patterson Corp., New York City.
Hubbard & Co., Pittsburgh, Pa.
Hurt & Co., Ferrum, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Meredith Co., Wm. C., Atlanta, Ga.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

POLE SUPPORTS

American Fork & Hoe Co., The, Cleveland, O.
Dicke Tool Co., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Star Bit & Tool Co., Rockford, Ill.

POLE TOP RINGS

See Rings—For Pole Top

POLES—CHESTNUT

American Forest Products Co., Inc., New York City.
Hatheway Patterson Corp., New York City.
Niedermeyer-Martin Lumber Co., Portland, Ore.

POLES—CYPRESS

American Cross-Arm, Inc., Jacksonville, Fla.
American Forest Products Co., Inc., New York City.
Central Lumber Sales Co., Lincoln, Neb.
Niedermeyer-Martin Lumber Co., Portland, Ore.

POLES—DOUGLAS FIR

American Cross-Arm, Inc., Jacksonville, Fla.
Central Lumber Sales Co., Lincoln, Neb.
Gilkey-Brown Cedar Co., Minneapolis, Minn.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Vreeland, B. F., Denver, Colo.
Wood Preserving Corp., The, Pittsburgh, Pa.

POLES—LODGEPOLE PINE

National Lumber & Creosoting Co., Texarkana, Tex.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Wood Preserving Corp., The, Pittsburgh, Pa.

POLES—NORTHERN WHITE CEDAR

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Forest Products Co., Inc., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Bell Lumber & Pole Co., Minneapolis, Minn.
Boom Lake Cedar Co., Rhinelander, Wis.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Carney & Co., B. J., Minneapolis, Minn.
Cedar River Lumber Co., Minneapolis, Minn.
Central Lumber Sales Co., Lincoln, Neb.
Comstock Cedar & Lumber Co., Rhinelander, Wis.
Cowling, Alfred E., Scotstown, Quebec, Canada.
● Graybar Electric Co., New York City.
Gilkey-Brown Cedar Co., Minneapolis, Minn.
Hatheway Patterson Corp., New York City.
Jents Cedar Co., Appleton, Wis.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Long-Bell Lumber Sales Corp., Kansas City, Mo.
● MacGillis & Gibbs Co., The, Milwaukee, Wis.
● Michigan Pole & Tie Co., Grand Rapids, Mich.
Miller Lumber Co., J. W., Minneapolis, Minn.
National Pole & Treating Co., Minneapolis, Minn.
Naugle Pole & Tie Co., Chicago, Ill.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Oneida Cedar & Lumber Co., Rhinelander, Wis.
Page & Hill Co., Minneapolis, Minn.
● Partridge Lumber Co., T. M., Minneapolis, Minn.
Republic Cedar Co., Marinette, Wis.
Scoville Timber Co., Winnipeg, Manitoba, Canada.
Sequin Co., Ltd., Montreal, Canada.
Standard Cedar Co., Minneapolis, Minn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
● Valentine & Clark Corp., St. Paul, Minn.

POLES—RED JUNIPER

Niedermeyer-Martin Lumber Co., Portland, Ore.

POLES—REDWOOD

Niedermeyer-Martin Lumber Co., Portland, Ore.

POLES—SOUTHERN WHITE CEDAR

● Allen Electric Co., The, Cleveland, O.
Hatheway Patterson Corp., New York City.
Jordan Bros. Lumber Co., Norfolk, Va.
Niedermeyer-Martin Lumber Co., Portland, Ore.

POLES—SOUTHERN YELLOW PINE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Creosote Works, New Orleans, La.
American Creosoting Co., Louisville, Ky.
American Cross-Arm, Inc., Jacksonville, Fla.
American Forest Products Co., Inc., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Ayer & Lord Div., The Wood Preserving Corp., Chicago, Ill.
Bond Bros., Birmingham, Ala.
Brown Wood Preserving Co., Inc., Louisville, Ky.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Central Lumber Sales Co., Lincoln, Neb.
Eppinger & Russell Co., New York City.
● Graybar Electric Co., New York City.
Gulfport Creosoting Co., Gulfport, Miss.
Gulf States Creosoting Co., Hattiesburg, Miss.
Hatheway Patterson Corp., New York City.
International Creosoting & Construction Co., Galveston, Tex.
Jackson Lumber Co., Lockhart, Ala.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Joyce Watkins Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Long-Bell Lumber Sales Corp., Kansas City, Mo.
Miller Lumber Co., J. W., Minneapolis, Minn.
Moss Tie Co., St. Louis, Mo.
National Lumber & Creosoting Co., Texarkana, Tex.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Norfolk Creosoting Co., Norfolk, Va.
Pensacola Creosoting Co., Pensacola, Fla.
Potosi Tie and Lumber Co., Dallas, Tex.
Republic Creosoting Co., Indianapolis, Ind.
Savannah Creosoting Co., Savannah, Ga.
Southern Wood Preserving Co., Atlanta, Ga.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Taylor-Colquitt Co., Spartanburg, S. C.
Texas Creosoting Co., Orange, Tex.
Union Electric Co., Indianapolis, Ind.
Wood Preserving Corp., The, Pittsburgh, Pa.
Wykoff Pipe & Dressing Co., The, New York City.

POLES—WESTERN RED CEDAR

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Forest Products Co., Inc., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Bell Lumber & Pole Co., Minneapolis, Minn.
Boom Lake Cedar Co., Rhinelander, Wis.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Carney & Co., B. J., Minneapolis, Minn.
Cascade Timber Co., Tacoma, Wash.
Cedar River Lumber Co., Minneapolis, Minn.
Central Lumber Sales Co., Lincoln, Neb.
Chapin Cedar Co., Salt Lake City, Utah.
Comstock Cedar & Lumber Co., Rhinelander, Wis.
Cowling, Alfred E., Scotstown, Quebec, Canada.
Gilkey-Brown Cedar Co., Minneapolis, Minn.
● Graybar Electric Co., New York City.
Hatheway Patterson Corp., New York City.
Jents Cedar Co., Appleton, Wis.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leavitt-Naugle Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Long-Bell Lumber Sales Corp., Kansas City, Mo.
● MacGillis & Gibbs Co., The, Milwaukee, Wis.
● Michigan Pole & Tie Co., Grand Rapids, Mich.
Miller Lumber Co., J. W., Minneapolis, Minn.
National Pole & Treating Co., Minneapolis, Minn.
Naugle Pole & Tie Co., Chicago, Ill.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Oneida Cedar & Lumber Co., Rhinelander, Wis.

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Page & Hill Co., Minneapolis, Minn.
● Partridge Lumber Co., T. M., Minneapolis, Minn.
Republic Cedar Co., Marinette, Wis.
Signlet & Co., Ltd., Lumby, B. C., Canada.
Standard Cedar Co., Minneapolis, Minn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Valentine & Clark Corp., St. Paul, Minn.
Vreeland, B. F., Denver, Colo.
Weyerhaeuser Pole Co., Minneapolis, Minn.

POLISHING CLOTHS—PLUG

Ideal Products Co., Grand Rapids, Mich.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.

POLISHING WHEELS

● Allen Electric Co., The, Cleveland, O.
Chicago Wheel & Mfg. Co., Chicago, Ill.
● Holtzer-Cabot Electric Co., The, Boston, Mass.

PORCELAIN BRACKETS

See Brackets—Porcelain

PORCELAIN INSULATORS

See Insulators—Porcelain

PORCELAIN KNOBS AND CLEATS

See Knobs and Cleats—Porcelain

POSTS AND STUBS

American Forest Products Co., Inc., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● MacGillis & Gibbs Co., The, Milwaukee, Wis.
Niedermeyer-Martin Lumber Co., Portland, Ore.
Potosi Tie & Lumber Co., Dallas, Tex.
Vreeland, B. F., Denver, Colo.

POTENTIOMETERS

Electrad, Inc., New York City.
Gray Instrument Co., Philadelphia, Pa.
International Resistance Co., Philadelphia, Pa.

POT HEAD COMPOUNDS

See Compounds—Cable and Pothead

POT HEADS

● Communication Equipment & Engineering Co., Chicago, Ill.
● Graybar Electric Co., New York City.
Line Material Co., South Milwaukee, Wis.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

POTS—MELTING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Berns Co., Inc., Otto, Rochester, N. Y.
Black & Decker Co., The, Towson, Md.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Littleford Bros., Cincinnati, O.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Struthers Dunn, Inc., Philadelphia, Pa.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Trent Co., Harold E., Philadelphia, Pa.
Turner Brass Works, The, Sycamore, Ill.
● Unique Mfg. Co., Chicago, Ill.
Van Praag Sales Corp., New York City.
Vulcan Electric Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

POTS—SOLDER

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Electrical Heating Co., Detroit, Mich.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Berns Co., Inc., Otto, Rochester, N. Y.
● Burning Brands Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Electric Soldering Iron Co., Inc., New York City.
Electro Engineering Co., Inc., Richmond Hill, N. Y.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Northern Electric Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Turner Brass Works, The, Sycamore, Ill.
● Unique Mfg. Co., Chicago, Ill.
Van Praag Sales Corp., New York City.
Vulcan Electric Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

POWER BOARDS

See Boards—Power

PRESERVATIVES—WOOD

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Creosote Works, New Orleans, La.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barrett Co., The, New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
C-A-Wood Preserver Co., St. Louis, Mo.
● Carbolineum Wood Preserving Co., Milwaukee, Wis.
Curtin-Howe Corp., New York City.
● Graybar Electric Co., New York City.
Gulfport Creosoting Co., Gulfport, Miss.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
National Lumber & Creosoting Co., Texarkana, Tex.
Osmose Corp. of America, Buffalo, N. Y.
Republic Creosoting Co., Indianapolis, Ind.
S. P. F. Wood-Preserving Co., Inc., Cambridge, Mass.
● Suttle Equipment Co., Lawrenceville, Ill.
Taylor-Colquitt Co., Spartanburg, S. C.
Texas Creosoting Co., Orange, Tex.
● Valentine & Clark Corp., St. Paul, Minn.
Vreeland, B. F., Denver, Colo.
Wood Preserving Corp., The, Pittsburgh, Pa.
Wykoff Pipe & Dressing Co., The, New York City.

PRIMARY BATTERIES

See Batteries—Primary

PRINTING—DIRECTORY

Clement Co., J. W., Buffalo, N. Y.
Cuneo Press, Inc., The, Chicago, Ill.
Defiance Printing & Engraving Co., Defiance, O.
Donnelley & Sons Co., R. R., Chicago, Ill.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
Wisconsin Cuneo Press, Inc., Milwaukee, Wis.

PRINTING—ENVELOPES, LETTERHEADS, ACCOUNTING FORMS, ETC.

Cuneo Press, Inc., The, Chicago, Ill.
Curran Printing Co., Con. P., St. Louis, Mo.
Defiance Printing & Engraving Co., Defiance, O.
Donnelley & Sons, R. R., Chicago, Ill.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
Remington Rand, Inc., Buffalo, N. Y.
Sherk, B. T., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Wisconsin Cuneo Press, Inc., Milwaukee, Wis.

PRINTING TELEGRAPH EQUIPMENT

Teletype Corp., Chicago, Ill.

PROGRAM SERVICE SYSTEMS

● Communication Equipment & Engineering Co., Chicago, Ill.
Edwards & Co., Inc., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
Stanley & Patterson, Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

PROTECTIVE EQUIPMENT—TELEPHONE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark N. J.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
● Cook Electric Co., Chicago, Ill.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Littelfuse Laboratories, Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

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Sundt Engineering Co., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PUBLIC ADDRESS EQUIPMENT

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cinaudagraph Corp., Stamford, Conn.
● Communication Equipment & Engineering Co., Chicago, Ill.
Couch Co., Inc., S. H., North Quincy, Mass.
Edwards & Co., Inc., New York City.
General Electric Co., Ltd., The, Coventry, England.
General Radio Co., Cambridge A, Mass.
Operadio Mfg. Co., St. Charles, Ill.
Stanley & Patterson, Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

PUBLISHING—DIRECTORY

Beatty Directory Co., Geo. F., St. Paul, Minn.
● Berry & Co., L. M., Dayton, O
Donnelley Corp., The Reuben H., Chicago, Ill.
Fort Wayne Printing Co., Fort Wayne, Ind.
General Telephone Directory Co., Madison, Wis.
Loomis Advertising Co., Kansas City, Mo.
National Telephone Directory Co., St. Louis, Mo.

RACKS—STORAGE BATTERY

● Electric Storage Battery Co., The, Philadelphia, Pa
● Gould Storage Battery Corp., Depew, N. Y.
Seeger Device Co., Toledo, O.

RADIO EQUIPMENT

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cinaudagraph Corp., Stamford, Conn.
● Communication Equipment & Engineering Co., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
Electrad, Inc., New York City.
General Electric Co., Ltd., The, Coventry, England.
General Radio Co., Cambridge A, Mass.
● Premax Sales Div., Chisholm-Ryder Co., Inc., Niagara Falls, N. Y.
Raytheon Production Corp., Newton, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
● Western Electric Co., New York City (Distributed by Graybar)

REBUILT TELEPHONE EQUIPMENT

● Albertson Electric Co., W. N., Milwaukee, Wis.
● Buckeye Telephone & Supply Co., Columbus, O.
● Independent Telephone Repair Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Rebuilt Electric Equipment Co., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Telephone Equipment Co., New York City.
● Telephone Repair Shop, The, Chicago, Ill.
Union Electric Co., Indianapolis, Ind.

RECEIVER HEAD BANDS

See Head Bands—Receiver

RECEIVERS—OPERATORS'

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

RECEIVERS—TELEPHONE

● American Automatic Electric Sales Co., Chicago, Ill.
American Record Corp., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

RECTIFIERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
B-L Electric Mfg. Co., St. Louis, Mo.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
● Fansteel Metallurgical Corp., North Chicago, Ill.
General Electric Co., Bridgeport, Conn.
General Radio Co., Cambridge A, Mass.
● Gould Storage Battery Corp., Depew, N. Y.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Operadio Mfg. Co., St. Charles, Ill.
Schauer Machine Co., The, Cincinnati, O.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
● Western Electric Co., New York City (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RED JUNIPER POLES

See Poles—Red Juniper

REDWOOD POLES

See Poles—Redwood

REELS—FISH TAPE

Barnard & Co., B. S., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Seeger Device Co., Toledo, O.

REELS—PAY-OUT AND TAKE-UP

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Coach & Body Co., The, Cleveland, O.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dicke Tool Co., Inc., The, Downers Grove, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Guardian Electric Mfg. Co., Chicago, Ill.
Highway Trailer Co., Milwaukee, Wis.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Matthews Corp., W. N., St. Louis, Mo.
Railroad Repair & Supply Co., Chicago, Ill.
● Ready Mfg. Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Utility Supply Co., Clintonville, Wis.

REELS—WIRE MEASURING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

RELAY SHELLS

● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

RELAYS—EXTENSION

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Benjamin Electric Mfg. Co., Des Plaines, Ill.

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Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
Guardian Electric Mfg. Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Roller-Smith Co., New York City.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Signal Engineering & Mfg Co., New York City.
Struthers Dunn, Inc., Philadelphia, Pa.
Telefon Fabrick Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

REPEATERS—TELEPHONE

● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

REPEATING COILS

See Coils—Repeating

RESISTANCE COILS

See Coils—Resistance

RESISTORS

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Electrad, Inc., New York City.
● Gould Storage Battery Corp, Depew, N. Y.
General Electric Co., Ltd., The, Coventry, England.
International Resistance Co., Philadelphia, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Muter Co., The, Chicago, Ill.
Noris Carbon Co., Inc., New York City.
● North Electric Mfg. Co., The, Galion, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Shallcross Mfg. Co., Collingdale, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Thompson Co., The, Philadelphia, Pa.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
● Western Electric Co., New York City (Distributed by Graybar)

REWOUND COILS

See Coils—Rewound

RINGER SETS—COMPOSITE

● Communication Equipment & Engineering Co., Chicago, Ill.
Pioneer Gen-E- Motor Corp., Chicago, Ill.

RINGERS—EXTENSION BELL

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Signal Engineering & Mfg. Co., New York City.
● Western Electric Co., New York City (Distributed by Graybar)
Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.

RINGING CONVERTERS

See Converters—Ringing

RINGING MACHINES—COMMON BATTERY, MAGNETO AND HARMONIC

● Albertson Electric Co., Milwaukee, Wis.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Electric Specialty Mfg. Co., Cedar Rapids, Ia.
General Electric Co., Ltd., The, Coventry, England.
General Radio Co., Cambridge A, Mass.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
● Lorain Products Corp., Lorain, O.
● North Electric Mfg. Co., The, Galion, O.
Railroad Repair & Supply Co., Chicago, Ill.
Roller-Smith Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Telkor, Inc., Elyria, O.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electric Instrument Co., Newark, N. J.

RINGS—AERIAL CABLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., B. A., Centralia, Mo.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Locke Insulator Corp., Baltimore, Md.
Minerallac Electric Co., Chicago, Ill.
● National Telephone Supply Co., The, Cleveland, O.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Pirelli General Cable Works, Ltd., Southampton, England.
Porcelain Products, Inc., Parkersburg, W. Va.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

RINGS—BRIDLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Locke Insulator Corp., Baltimore, Md.
● National Telephone Supply Co., The, Cleveland, O.
Paine Co., Chicago, Ill.
Porcelain Products, Inc., Parkersburg, W. Va.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

RINGS—DISTRIBUTING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Locke Insulator Corp., Baltimore, Md.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.

RINGS—POLE TOP

● Allen Electric Co., The, Cleveland, O.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Leich Electric Co., Genoa, Ill.
Locke Insulator Corp., Baltimore, Md.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

RODS—ANCHOR

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.

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Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

RODS—CONDUIT

● Allen Electric Co., The, Cleveland, O.
Barnard & Co., B. S., New York City.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Dicke Tool Co., The, Downers Grove, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

RODS—GROUND

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Materal Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Metropolitan Device Corp., Brooklyn, N. Y.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
● Premax Sales Div., Chisholm-Ryder Co., Inc., Niagara Falls, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.

RODS—GUY

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia ,Mo.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Synthane Corp., Oaks, Pa.
Union Electric Co., Indianapolis, Ind.

ROPE AND CABLE—WIRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Chain Co., Inc., Bridgeport, Conn.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leadclad Wire Co., Moundsville, W. Va.
Lewis Bolt & Nut Co., Minneapolis, Minn.
National Electric Products Corp., Pittsburgh, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

RUBBER COMPOUNDS

See Compounds—Rubber; Also Compounds—Plastic and Liquid Rubber

RUBBER COVERED CABLE

See Cable—Rubber Covered

SAFETY FIRST EQUIPMENT

American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Davis Emergency Equipment Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Mine Safety Appliances Co., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.

SAFETY STRAPS

See Belts and Safety Straps

SCISSORS—ELECTRICIANS'

● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.

SCREWDRIVERS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Black & Decker Mfg. Co., The, Towson, Md.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
● Forged Steel Products Co., Newport, Pa.
● Graybar Electric Co., New York City.
Haskins Co., R. G., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
North Bros. Mfg. Co., Philadelphia, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

SCREWS—ALL KINDS

American Screw Co., Providence, R. I.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Screw Machine Products Corp., The, Providence, R. I.

SCREWS—LAG

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.

SELF-CONTAINED TELEPHONES

See Telephones—Self-Contained

SELF-FLUXING SOLDER

See Solder—Self Fluxing

SHELVING—STEEL

Globe-Wernicke Co., The, Norwood, Cincinnati, O.
Lyon Metal Products, Inc., Aurora, Ill.
Medart Mfg. Co., Fred, St. Louis, Mo.
Warren Mfg. Co., J. D., Montpelier, O.

SHOVELS

See Digging Tools

SHUNTS AND MULTIPLIERS

See Electrical Instruments—Shunts and Multipliers

SIGNAL SYSTEMS—COMMERCIAL AND INDUSTRIAL

● Albertson Electric Co., Milwaukee, Wis.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.

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Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Communication Equipment & Engineering Co., Chicago, Ill.
Couch Co., Inc., S. H., North Quincy, Mass.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Guardian Electric Mfg. Co., Chicago, Ill.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Operadio Mfg. Co., St. Charles, Ill.
Padua Hold-Up Alarm Co., Inc., Cohoes, N. Y.
● Paragon Electric Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Signal Engineering & Mfg. Co., New York City.
Signaphone Corp. of America, New York City.
Stanley & Patterson, Inc., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

SIGNS—ADVERTISING AND DISPLAY

Acme Changeable Sign Co., New York City.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Burdick Enamel Sign Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Delta Manufacturing Co., Chicago, Ill.
Ingram Richardson Mfg. Co., Beaver Falls, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Page Steel & Wire Div., American Chain Co., Inc., Bridgeport, Conn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Wisconsin Cuneo Press, Inc., Milwaukee, Wis.

SIGNS—BRONZE

Acme Changeable Sign Co., New York City.
Matthews & Co., Jas. H., Pittsburgh, Pa.

SIGNS—PAY STATION

Burdick Enamel Sign Co., Chicago, Ill.

SIGNS AND SIGNALS—WARNING

Acme Changeable Sign Co., New York City.
● Allen Electric Co., The, Cleveland, O.
American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Burdick Enamel Sign Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Delta Manufacturing Co., Chicago, Ill.
● Graybar Electric Co., New York City.
Ingram Richardson Mfg. Co., Beaver Falls, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Leach Co., Oshkosh, Wis.
Martindale Electric Co., The, Cleveland, O.
Matthews & Co., Jas. H., Pittsburgh, Pa.
Mine Safety Appliances Co., Pittsburgh, Pa.
Railroad Repair & Supply Co., Chicago, Ill.
Seeger Device Co., Toledo, O.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Toledo Pressed Steel Co., The, Toledo, O.

SLEEVE TOOLS

● Allen Electric Co., The, Cleveland, O.
Aluminum Co. of America, Pittsburgh, Pa.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Crescent Tool Co., Jamestown, N. Y.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
● National Telephone Supply Co., The, Cleveland, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefon Fabrik Automatic, Copenhagen, Denmark.

SLEEVES—CABLE

● Allen Electric Co., The, Cleveland, O.
Aluminum Co. of America, Pittsburgh, Pa.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Pekeu Co., The, Brooklyn, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

SLEEVES—PAPER

● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Reliable Electric Co., Chicago, Ill.
Stone Paper Tube Co., Washington, D. C.

SLEEVES—WIRE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cook Electric Co., Chicago, Ill.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
● Leich Electric Co., Genoa, Ill.
Hope Webbing Co., Inc., Pawtucket, R. I.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
● National Telephone Supply Co., The, Cleveland, O.
Pekeu Co., The, Brooklyn, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

SLEEVING—LEAD

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Eagle-Picher Sales Co., Cincinnati, O.
● Gardiner Metal Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
● Union Electric Co., Indianapolis, Ind.

SLIDE RULES

Keuffel & Esser Co., Hoboken, N. J.
Tavella Sales Co., New York City.

SOLDER—BAR

● Allen Co., L. B., Chicago, Ill.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Berry Solder Co., Inc., New York City.
British Insulated Cables, Ltd., Prescot, Lancashire, England
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Eagle-Picher Sales Co., The, Cincinnati, O.
● Gardiner Metal Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Kester Solder Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Mitchell-Rand Insulation Co., Inc., New York City.
National Lead Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

SOLDER—SELF-FLUXING

● Allen Co., L. B., Chicago, Ill.
● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Berry Solder Co., Inc., New York City.
● Brach Mfg. Corp., L. S., Newark, N. J.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.

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STUBS

See Posts and Stubs

SUBMARINE CABLE

See Cable—Submarine

SUBSCRIBER TRANSFER UNITS

● Leich Electric Co., Genoa, Ill.

SUPERVISOR SETS

See Operators' Supervisor Sets

SURVEYING EQUIPMENT

Keuffel & Esser Co., Hoboken, N. J.

SWITCHBOARD CABINETS

See Cabinets—Switchboard

SWITCHBOARD CABLE

See Cable—Switchboard

SWITCHBOARD CABLE IMPREGNATING WAX

See Wax—Swtichboard Cable Impregnating

SWITCHBOARD CLEANING EQUIPMENT

See Cleaning Equipment—Switchboard

SWITCHBOARD CORDS

See Cords—Switchboard and Telephone

SWITCHBOARD COUNTERS

See Counters—Switchboard

SWITCHBOARD COVERS

See Covers—Switchboard

SWITCHBOARD AND MINIATURE LAMPS

See Lamps—Switchboard and Miniature

SWITCHBOARD PLUGS

See Plugs—Switchboard

SWITCHBOARD WIRE

See Wire—Switchboard

SWITCHBOARDS—ALL-RELAY

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Telefon Fabrik Automatic, Copenhagen, Denmark.

SWITCHBOARDS—AUTOMANUAL

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

SWITCHBOARDS—AUTOMATIC

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Telephone Equipment Co., New York City.
● Western Electric Co., New York City (Distributed by Graybar)

SWITCHBOARDS—MAGNETO

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Telephone Supply Co., Elkhart, Ind.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

SWITCHBOARDS—MANUAL

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

SWITCHBOARDS—P-B-A-X

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.

SWITCHBOARDS—P-B-X

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)

SWITCHES—BATTERY

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Porcelain Products, Inc., Parkersburg, W. Va.
Railroad Repair & Supply Co., Chicago, Ill.
Square D Co., Detroit, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

SWITCHES—KNIFE

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Muter Co., The, Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Thompson Co., The, Philadelphia, Pa.
Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.

SWITCHES—TIME

Cleveland Time Clock and Service Co., Cleveland, O.
Guardian Electric Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Line Material Co., South Milwaukee, Wis.
Railroad Repair & Supply Co., Chicago, Ill.

TACKLE BLOCKS

See Blocks—Tackle

● Advertisement in this issue—See Index to Advertisers, Page 106

Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cook Electric Co., Chicago, Ill.
Dunton Co., The M. W., Providence, R. I.
Eagle-Picher Sales Co., The, Cincinnati, O.
● Gardiner Metal Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Kester Solder Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

SOLDER POTS

See Pots—Solder

SOLDER TEMPERATURE REGISTERING INSTRUMENTS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bristol Co., The, Waterbury, Conn.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Dillon Mfg. Co., Chicago, Ill.
Illinois Testing Laboratories, Inc., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

SOLDERING IRONS—ELECTRIC

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
American Electrical Heater Co., Detroit, Mich.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Electric Soldering Iron Co., Inc., New York City.
● Graybar Electric Co., New York City.
Hexacon Electric Appliance Corp., Roselle Park, N. Y.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Specialties Co., Fort Wayne, Ind.
Northern Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Union Electric Co., Indianapolis, Ind.
Van Praag Sales Corp., New York City.
Vulcan Electric Co., Lynn, Mass.
Vulcan Electric Heater Corp., New York City.

SOLDERING FLUIDS, PASTE AND SALTS

● Allen Co., L. B., Chicago, Ill.
Johnson Mfg. Co., Chicago, Ill.

SOLDERING FLUX

See Flux—Soldering

SOLDERING TORCHES

See Torches—Soldering

SOUTHERN WHITE CEDAR POLES

See Poles—Southern White Cedar

SOUTHERN YELLOW PINE POLES

See Poles—Southern Yellow Pine

SPLICING CLAMPS

See Clamps—Splicing

SPOONS

See Digging Tools

SPUDS

See Digging Tools

SPUR GAUGES

See Gauges—Linemen's Spur

STAMPING DIES

See Dies—Stamping

STAPLES

● American Steel & Wire Co., Chicago, Ill.
Copperweld Co., Glassport, Pa.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Keystone Steel & Wire Co., Peoria, Ill.
Paine Co., Chicago, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

STAPLES—INSULATED

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
Emerson Apparatus Co., Melrose, Mass.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

STATIONERY

See Printing—Envelopes, Letterheads, Accounting Forms, Etc.

STEEL TUBING—ELECTRICAL CONDUIT

● Allen Electric Co., The, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
● Graybar Electric Co., New York City.
National Electric Products Corp., Pittsburgh, Pa.
Steel & Tubes, Inc., Cleveland, O.

STILLS—BATTERY WATER

Barnstead Still & Sterilizer Co., Inc., Forest Hills, Boston, Mass.
● Malloy Mfg. Co., Madison, Wis.
Mine Safety Appliances Co., Pittsburgh, Pa.
Sparta Mfg. Co., Muskegon, Mich.
Weber Bros. Metal Works, Chicago, Ill.

STORAGE BATTERIES

See Batteries—Storage

STORAGE BATTERY RACKS

See Racks—Storage Battery

STRAIN PLATES

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Star Bit & Tool Co., Rockford, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Utilities Service Co., Inc., Allentown, Pa.
Wrought Washer Mfg. Co., Milwaukee, Wis.

STRAND—GUY AND MESSENGER

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Chain Co., Inc., Bridgeport, Conn
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
● Indiana Steel & Wire Co., Muncie, Ind.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Line Material Co., South Milwaukee, Wis.
Page Steel & Wire Div., American Chain Co., Inc., Bridgeport, Conn.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

STUBBING CLAMPS

See Clamps—Stubbing

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TACKLES

Barnard & Co., B. S., New York City.
● Chance Co., A. B., Centralia, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Western Block Co., Lockport, N. Y.

TACKS—INSULATED

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genon, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

TAMPING BARS

See Bars—Crow, Digging and Tamping

TAPE—COIL

Seeger Device Co., Toledo, O.
Van Cleef Bros., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TAPE—FRICTION

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dunton Co., The M. W., Providence, R. I.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Bridgeport, Conn.
Goodrich Co., The B. F., Akron, O.
● Graybar Electric Co., New York City.
Johns-Manville, New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genon, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., J. A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericason, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
Van Cleef Bros., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TAPE—INSULATING

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Dunton Co., The M. W., Providence, R. I.
Elkhart Rubber Works, Elkhart, Ind.
General Electric Co., Bridgeport, Conn.
Goodrich Co., The B. F., Akron, O.
● Graybar Electric Co., New York City.
Hope Webbing Co., Inc., Pawtucket, R. I.
Johns-Manville, New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
Ruberoid Co., The, New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Van Cleef Bros., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TAPE—WHITE ADHESIVE

● Leich Electric Co., Genoa, Ill.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Van Cleef Bros., Chicago, Ill.

TAPPING EQUIPMENT

Haskins Co., R. G., Chicago, Ill.
North Bros. Mfg. Co., Philadelphia, Pa.

TELEPHONE AMPLIFIERS

See Amplifiers—Telephone

TELEPHONE ARMS

See Arms, Brackets and Holders—Telephone

TELEPHONE BOOTH VENTILATORS

See Ventilators—Telephone Booth

TELEPHONE PAY STATION BOOTHS

See Booths—Telephone Pay Station

TELEPHONE BRACKETS

See Arms, Brackets and Holders—Telephone

TELEPHONE CABINETS

See Cabinets—Telephone

TELEPHONE CORDS

See Cords—Switchboard and Telephone

TELEPHONE HOLDERS

See Arms, Brackets and Holders—Telephone

TELEPHONE RECEIVERS

See Receivers—Telephone

TELEPHONE REPEATERS

See Repeaters—Telephone

TELEPHONES—AUTOMATIC

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Telephone Equipment Co., New York City.
● Western Electric Co., New York City (Distributed by Graybar)

TELEPHONES—INTERCOMMUNICATING

Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Screw Machine Products Corp., The, Providence, R. I.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Telephone Equipment Co., New York City.
Union Electric Co., Indianapolis, Ind.

TELEPHONES—LOCK-OUT AND SELECTIVE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Graybar Electric Co., New York City.
Screw Machine Products Corp., The, Providence, R. I.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Telephone Equipment Co., New York City.

TELEPHONES—MAGNETO

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Chicago Telephone Supply Co., Elkhart, Ind.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

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● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

TELEPHONES—MANUAL

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Couch Co., Inc., S. H., North Quincy, Mass.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● North Electric Mfg. Co., The, Galion, O.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

TELEPHONES—OUTDOOR AND MINE

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Western Electric Co., New York City (Distributed by Graybar)

TELEPHONES—PAY STATION

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
Gray Telephone Pay Station Co., Hartford, Conn.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

TELEPHONES—SELF-CONTAINED

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

TELETYPEWRITERS

Teletype Corp., Chicago, Ill.

TEMPEROMETERS—FOR REGISTERING TEMPERATURE OF COMPOUND, PARAFFIN, SOLDER, WAX

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Dillon Mfg. Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

TEMPORARY CROSS-ARMS

See Cross-Arms—Temporary

TENSION INDICATORS

See Indicators—Tension

TENTS—CABLE SPLICERS'

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
U. S. Tent & Awning Co., Chicago, Ill.

TERMINAL BLOCKS

See Blocks—Terminal

TERMINAL BOXES

See Boxes—Terminal

TERMINALS—CABLE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Brach Mfg. Corp., L. S., Newark, N. J.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Cook Electric Co., Chicago, Ill.
Frankel Connector Co., Inc., New York City.
● Graybar Electric Co., New York City.
High Tension Co., Inc., The, Phillipsburg, N. J.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Co., Pittsburgh, Pa.
● Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

TESTBOARDS

● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.

TEST CLAMPS

See Clamps—Test

TEST SETS

See Electrical Instruments—Test Sets

TIE WIRE

See Wire—Tie

TIME RECORDERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Babcock, Garrison, Seattle, Wash.
Bristol Co., The, Waterbury, Conn.
● Calculagraph Co., Harrison, N. J.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleveland Time Clock & Service Co., Cleveland, O.
Graves Co., C. H. Philadelphia, Pa.
● Graybar Electric Co., New York City.
● Holtzer-Cabot Electric Co., The, Boston, Mass.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Northwestern Clock Co., The, Omaha, Neb.
Paragon Electric Co., Chicago, Ill.
● Stromberg Electric Co., Chicago, Ill.
Struthers Dunn, Inc., Philadelphia, Pa.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Weston Electrical Instrument Corp., Newark, N. J.

TIRES—AUTOMOBILE AND TRUCK

Firestone Tire & Rubber Co., Akron, O.
Goodrich Co., The B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
U. S. Rubber Co., New York City.

TOGGLE BOLTS

See Bolts—Toggle

TOLL TICKET CARRIERS

● Blackburn Products Corp., Jasper, St. Louis, Mo.

TOLL TICKETS

Defiance Printing & Engraving Co., Defiance, O.
Ft. Wayne Printing Co., Ft. Wayne, Ind.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.
Wisconsin Cuneo Press, Inc., Milwaukee, Wis.

TOOL BAGS

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Buhrke Co., R. H., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Davis Emergency Equipment Co., New York City.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

TOOL BOXES

● Allen Electric Co., The, Cleveland, O.
All-Steel Equipment Co., Aurora, Ill.
Angle Steel Stool Co., Inc., Plainwell, Mich.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carslon Telephone Mfg. Co., Rochester, N. Y.

TOOL KITS

● Graybar Electric Co., New York City.
● Klein & Sons, Mathias, Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.

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TORCHES—ALCOHOL SELF-ACTING

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
Barnard & Co., B. S., New York City.
Bernz Co., Inc., Otto, Rochester, N. Y.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Turner Brass Works, The, Sycamore, Ill.
Van Praag Sales Corp., New York City.

TORCHES—BRAZING

American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Indiana Oxygen Co., Indianapolis, Ind.
Linde Air Products Co., The, New York City.
Railroad Repair & Supply Co., Chicago, Ill.
● Unique Mfg. Co., Chicago, Ill.
Van Praag Sales Corp., New York City.

TORCHES—GASOLINE-BLOW

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Bernz Co., Inc., Otto, Rochester, N. Y.
● Burning Brands Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clayton & Lambert Mfg. Co., Detroit, Mich.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Turner Brass Works, The, Sycamore, Ill.
● Unique Mfg. Co., Chicago, Ill.
Van Praag Sales Corp., New York City.
Wall Mfg. Supply Co., P., Pittsburgh, Pa.

TORCHES—KEROSENE-BLOW

Barnard & Co., B. S., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Uniqque Mfg. Co., Chicago, Ill.
Wall Mfg. Supply Co., P., Pittsburgh, Pa.

TORCHES—OXY-ACETYLENE

Air Reduction Sales Co., New York City.
American Allsafe Co., Buffalo, N. Y.
Indiana Oxygen Co., Indianapolis, Ind.
Linde Air Products Co., The, New York City.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.

TORCHES—SOLDERING

● Allen Electric Co., The, Cleveland, O.
American Allsafe Co., Buffalo, N. Y.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Bernz Co., Inc., Otto, Rochester, N. Y.
● Burning Brands Co., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clayton & Lambert Mfg. Co., Detroit, Mich.
● Graybar Electric Co., New York City.
Indiana Oxygen Co., Indianapolis, Ind.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Linde Air Products Co., The, New York City.
Railroad Repair & Supply Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Turner Brass Works, The, Sycamore, Ill.
Union Electric Co., Indianapolis, Ind.
● Unique Mfg. Co., Chicago, Ill.
Van Praag Sales Corp., New York City.
Wall Mfg. Supply Co., P., Pittsburgh, Pa.

TORCHES—WELDING

Air Reduction Sales Co., New York City.
American Allsafe Co., Buffalo, N. Y.
Barnard & Co., B. S., New York City.
Indiana Oxygen Co., Indianapolis, Ind.
Linde Air Products Co., The, New York City.
Schramm, Inc., West Chester, Pa.
● Leich Electric Co., Genoa, Ill.

TRACTORS

Baker-Raulang Co., The, Cleveland, O.
Brockway Motor Truck Co., Inc., Cortland, N. Y.
Caterpillar Tractor Co., Peoria, Ill.
Cleveland Tractor Co., The, Cleveland, O.
Consolidated Motors Corp., Lima, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
International Harvester Co. of America, Chicago, Ill.
Mack Trucks, Inc., New York City.
Trackson Co., Milwaukee, Wis.

TRAILERS—AUTOMOBILE and TRUCK

American Coach & Body Co., The, Cleveland, O.
Consolidated Motors Corp., Lima, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
Fruehauf Trailer Co., Detroit, Mich.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
Line Material Co., South Milwaukee, Wis.
Littleford Bros., Cincinnati, O.
Mack Trucks, Inc., New York City.
McCabe-Powers Auto Body Co., St. Louis, Mo.
Omaha Standard Body Corp., Council Bluffs, Ia.
Utility Supply Co., Clintonville, Wis.
Utility Trailer Mfg. Co., Los Angeles, Calif.

TRANSFORMERS

See Ringing Machines

TRANSMISSION TEST SETS

See Electrical Instruments—Transmission Test Sets

TRANSMITTER CARBON

See Carbon—Granular

TRANSMITTER DISCS

● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Union Electric Co., Indianapolis, Ind.

TRANSMITTERS

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium .
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
General Electric Co., Ltd., The, Coventry, England.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Screw Machine Products Corp., The, Providence, R. I.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefon Fabrik Automatic, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)

TREE TRIMMING SERVICE

Asplundh Tree Expert Co., Glenside, Pa.
● Bartlett Tree Expert Co., F. A., Stamford, Conn.
Condon Co., Inc., Maurice L., White Plains, N. Y.
● Davey Tree Expert Co., Inc., The, Kent, O.
● Graybar Electric Co., New York City.

TREE TRIMMING EQUIPMENT

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Fork & Hoe Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Baker-Raulang Co., The, Cleveland, O.
● Bartlett Mfg. Co., Detroit, Mich.
Buhrke Co., R. H., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Clyde Cutlery Co., Clyde, O.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
Leach Co., Oshkosh, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.
Porter, Inc., H. K., Everett, Mass.
● Seymour Smith & Son, Inc., Oakville, Conn.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

TREE WIRE GUARDS

See Guards—Tree Wire

TRENCH DIGGERS

See Diggers—Trench

TRUCK BODIES

● American Automatic Electric Sales Co., Chicago, Ill.
● American Coach & Body Co., The, Cleveland, O.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.

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Baker-Raulang Co., The, Cleveland, O.
Brockway Motor Truck Co., Inc., Cortland, N. Y.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Motors Corp., Lima, O.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
International Harvester Co. of America, Chicago, Ill.
Mack Trucks, Inc., New York City.
McCabe-Powers Auto Body Co., St. Louis, Mo.
Omaha Standard Body Corp., Council Bluffs, Ia.
Utility Supply Co., Clintonville, Wis.
York-Hoover Body Corp., York, Pa.

TRUCK RECORDERS

Service Recorder Co., The, Cleveland, O.

TWINE—ELECTRIC

● Kellogg Switchboard & Supply Co., Chicago, Ill.
● North Electric Mfg. Co., The, Galion, O.
Union Electric Co., Indianapolis, Ind .

TWIST ANCHORS

See Anchors—Twist

TYPEWRITERS

Burroughs Adding Machine Co., Detroit, Mich.
Remington Rand, Inc., Buffalo, N. Y.
Underwood Elliott Fisher Co., New York City.

UNDERGROUND EQUIPMENT

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cleveland Trencher Co., The, Cleveland, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.
Seeger Device Co., Toledo, O.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Utility Supply Co., Clintonville, Wis.

VALUATIONS

See Engineers—Appraisal, Consulting, Valuation and Contracting

VENTILATORS—TELEPHONE BOOTH

● Churchill Cabinet Co., Chicago, Ill.
Stephenson Engineering Co., Auburn, N. Y.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

VOLT METERS

See Electrical Instruments—Volt Meters

WASHERS AND STAMPINGS

Cleverly Electrical Works, Inc., Philadelphia, Pa.
● Graybar Electric Co., New York City.
Hipwell Mfg. Co., N. S., Pittsburgh, Pa.
Hubbard & Co., Pittsburgh, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Locke Insulator Corp., Baltimore, Md.
Oliver Iron & Steel Corp., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WATER PURIFYING AND SOFTENING EQUIPMENT—STORAGE BATTERY

Bardstead Still & Sterilizer Co., Inc., Boston, Mass.
Malloy Mfg. Co., Madison, Wis.

WATER STILLS

See Stills—Battery Water

WAX—SWITCHBOARD CABLE IMPREGNATING

● Buckeye Telephone & Supply Co., Columbus, O.
● Leich Electric Co., Genoa, Ill.
Mitchell-Rand Insulation Co., New York City.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

WAX HEATERS

Electro Engineering Co., Inc., Richmond Hill, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.

WAX TEMPERATURE REGISTERING INSTRUMENTS

See Temperometers—For Registering Temperatures of Compound, Parafin, Solder, Wax

WEED CUTTING EQUIPMENT—LINEMEN'S

American Fork & Hoe Co., The, Cleveland, O.
Joslyn Mfg. & Supply Co., Chicago, Ill.

WELDING TORCHES

See Torches—Welding

WESTERN RED CEDAR POLES

See Poles—Western Red Cedar

WHEATSTONE BRIDGES

See Electrical Instruments—Galvanometers and Wheatstone Bridges

WINCHES—POWER

● American Coach & Body Co., The, Cleveland, O.
Cleveland Tractor Co., The, Cleveland, O.
Four Wheel Drive Auto Co., Clintonville, Wis.
● Graybar Electric Co., New York City.
Highway Trailer Co., Edgerton, Wis.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
McCabe-Powers Auto Body Co., St. Louis, Mo.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Utility Supply Co., Clintonville, Wis.
Wood Industries, Inc., Gar, Detroit, Mich.

WIPING CLOTHS

● American Automatic Electric Sales Co., Chicago, Ill.
American Hoist & Derrick Co., St. Paul, Minn.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Barnard & Co., B. S., New York City.
Bernz Co., Inc., Otto, Rochester, N. Y.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Mineralac Electric Co., Chicago, Ill.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
● Unique Mfg. Co., Chicago, Ill.
Williams, Mfg., Geo. E., Minneapolis, Minn.

WIRE—BRIDLE

Acorn Insulated Wire Co., Brooklyn, N. Y.
● Allen Electric Co., The, Cleveland O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)
● Whitney Blake Co., The, Hamden, Conn.

WIRE—ENAMELED

● Allen Electric Co., The, Cleveland O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
Copperweld Co., Glassport, Pa.
● Habirshaw Cable & Wire Corp., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
Siemens Bros. & Co., Ltd., Woolwich, London, England.
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)
● Whitney Blake Co., The, Hamden, Conn.

WIRE—FLAMEPROOF JUMPER

● Allen Electric Co., The, Cleveland O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium .

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● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
General Electric Co., Ltd., The, Coventry, England.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
● Runzel Cord & Wire Co., Chicago, Ill.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Western Electric Co., New York City (Distributed by Graybar)
● Whitney Blake Co., The, Hamden, Conn.

WIRE—FUSE

● Allen Electric Co., The, Cleveland O.
Aluminum Co. of America, Pittsburgh, Pa.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Wire & Associated Corp., Chicago, Ill.
● Cook Electric Co., Chicago, Ill.
● Graybar Electric Co., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Littelfuse Laboratories, Chicago, Ill.
Pirelli General Cable Works, Ltd., Southampton, England.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

WIRE—INSULATED DROP BRONZE

Acorn Insulated Wire Co., Brooklyn, N. Y.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Union Electric Co., Indianapolis, Ind.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—INSULATED DROP COPPER

Acorn Insulated Wire Co., Brooklyn, N. Y.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Co., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—INSULATED DROP COPPERWELD

Acorn Insulated Wire Co., Brooklyn, N. Y.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Wire & Associated Corp., Chicago, Ill.
Cooperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Union Electric Co., Indianapolis, Ind.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—INSULATED DROP IRON

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Wire & Associated Corp., Chicago, Ill.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—INTERIOR

Acorn Insulated Wire Co., Brooklyn, N. Y.
● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Consolidated Wire & Associated Corp., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Paragon Electric Co., Chicago, Ill.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
● Runzel Cord & Wire Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—MAGNET

● Allen Electric Co., The, Cleveland, O.
Allied Radio Corp., Chicago, Ill.
● American Automatic Electric Sales Co., Chicago, Ill.
American Electrical Works, Phillipsdale, R. I.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.

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● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Consolidated Wire & Associated Corp., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
General Electric Co., Bridgeport, Conn.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Railroad Repair & Supply Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

WIRE—OPEN COPPERWELD

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Copperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Kennecott Wire & Cable., Phillipsdale, R. I.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.

WIRE—OPEN GALVANIZED STEEL

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
American Chain Co., Inc., Bridgeport, Conn.
● American Steel & Wire Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown Fence & Wire Co., The, Cleveland, O.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Graybar Electric Co., New York City.
● Indiana Steel & Wire Co., Muncie, Ind.
Joslyn Mfg. & Supply, Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Keystone Steel & Wire Co., Peoria, Ill.
Page Steel & Wire Div., American Chain Co., Inc., Bridgeport, Conn.
● Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
● Suttle Equipment Co., Lawrenceville, Ill.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

WIRE—OPEN HARD DRAWN COPPER

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Automatique Electrique de Belgique, Antwerp, Belgium .
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Copperweld Co., Glassport, Pa.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, N. Y.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
Union Electric Co., Indianapolis, Ind.

WIRE—SWITCHBOARD

● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
● Buckeye Telephone & Supply Co., Columbus, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Communication Equipment & Engineering Co., Chicago, Ill.
Crescent Instrument Wire & Cable Co., Trenton, N. J.
General Electric Co., Bridgeport, Conn.
General Electric Co., Ltd., The, Coventry, England.
● Habirshaw Cable & Wire Corp., New York City.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
● North Electric Mfg. Co., The, Galion, O.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Pirelli General Cable Works, Ltd., Southampton, England.
Providence Insulated Wire Co., Providence, R. I.
Roebling's Sons Co., John A., Trenton, N. J.
● Runzel Cord & Wire Co., Chicago, Ill.
Screw Machine Products Corp., The, Providence, R. I.
Simplex Wire & Cable Co., Boston, Mass.
● Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Western Electric Co., New York City (Distributed by Graybar)
● Whitney Blake Co., The, Hamden, Conn.

WIRE—TIE

● Allen Electric Co., The, Cleveland, O.
● American Automatic Electric Sales Co., Chicago, Ill.
● American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York City.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Brown Fence & Wire Co., The, Cleveland, O.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
Cooperweld Co., Glassport, Pa.
● Graybar Electric Co., New York City.
● Habirshaw Cable & Wire Corp., New York City.
● Indiana Steel & Wire Co., Muncie, Ind.
Joslyn Mfg. & Supply Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
Keystone Steel & Wire Co., Peoria, Ill.
● Leich Electric Co., Genoa, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Page Steel & Wire Div., American Chain Co., Inc., Bridgeport, Conn.
Roebling's Sons Co., John A., Trenton, N. P.
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ont., Canada.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.
● Whitney Blake Co., The, Hamden, Conn.

WIRE—TREE

● American Steel & Wire Co., Chicago, Ill.
● Communication Equipment & Engineering Co., Chicago, Ill.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
National Electric Products Corp., Pittsburgh, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
● Whitney Blake Co., The, Hamden, Conn.

WIRE CUTTERS

See Pliers and Wire Cutters

WIRE GRIPS

See Grips—Wire

WIRE MEASURING REELS

See Reels—Wire Measuring

WIRE ROPE REELS

See Reels—Wire Rope

WIRE SLEEVES

See Sleeves—Wire

WIRE-SOLDERLESS CONNECTORS

See Connectors—Wire-Solderless

WIRE-STRIPPERS

Pyramid Products Co., Chicago, Ill.

WIRING NAILS

See Nails—Wiring

WOOD ANCHORS

See Anchors—Wood

WOOD PRESERVATIVES

See Preservatives—Wood

WRENCHES

● American Automatic Electric Sales Co., Chicago, Ill.
● Automatic Electric Sales Co., Ltd., Chicago, Ill.
Canadian Telephones & Supplies, Ltd., Toronto, Canada.
● Chance Co., A. B., Centralia, Mo.
Cleverly Electrical Works, Inc., Philadelphia, Pa.
Crescent Tool Co., Jamestown, N. Y.
● Graybar Electric Co., New York City.
Kearney Corp., Jas. R., St. Louis, Mo.
● Kellogg Switchboard & Supply Co., Chicago, Ill.
● Klein & Sons, Mathias, Chicago, Ill.
● Leich Electric Co., Genoa, Ill.
Railroad Repair & Supply Co., Chicago, Ill.
● Reliable Electric Co., Chicago, Ill.
Roebling's Sons Co., John A., Trenton, N. J.
Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden.

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Telephone Engineer

1937 DIRECTORY NUMBER

● SECTION 2---MANUFACTURERS' ADDRESSES ●

A

Acme Card System Co., 8 S. Michigan Ave., Chicago, Ill.
Acme Changeable Sign Co., 214 E. 37th St., New York City.
Acorn Insulated Wire Co., 225 King St., Brooklyn, N. Y.
Addressograph-Multigraph Corp., 1200 Babbitt Road, Cleveland, O.
● Aiken Anchor Co., 114 N. 7th St., St. Louis, Mo.
Air Reduction Sales Co., 60 E. 42nd St., New York City.
Alamo Iron Works, San Antonio, Tex.
● Albertson Electric Co., 3530-34 W. Pierce St., Milwaukee, Wis.
● Allen Co., L. B., 6727 Bryn-Mawr Ave., Chicago, Ill.
● Allen Electric Co., The, 2120 N. 19th St., Cleveland, O.
Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.
All-Steel-Equipment Co., Inc., Aurora, Ill.
Alton Battery Co., Ltd., The, Alton Hants, England.
Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa.
American Allsafe Co., 210 Franklin St., Buffalo, N. Y.
American Appraisal Co., The, 525 E. Michigan St., Milwaukee, Wis.
● American Automatic Electric Sales Co., 1033 W. Van Buren St., Chicago, Ill.
American Chain Co., Inc. & Associate Companies, 929 Connecticut Ave., Bridgeport, Conn.
● American Coach & Body Co., The, Woodlawn Ave., & E. 93rd. St., Cleveland, O.
● American Creosote Works, 1305 Dublin St., New Orleans, La.
American Creosoting Co., 401 W. Main St., Louisville, Ky.
American Crossarm & Conduit Co., 22 W. Monroe St., Chicago, Ill.
American Cross-Arm, Inc., 111 W. Ashley St., Jacksonville, Fla.
American Electrical Heater Co., 6110 Cass Ave., Detroit, Mich.
American Electrical Works, Phillipsdale, R. I.
American Forest Products Co., Inc., 60 E. 42nd St., New York City.
American Fork & Hoe Co., The, 1623 Euclid Ave., Cleveland, O.
American Hoist & Derrick Co., 63 S. Robert St., St. Paul, Minn.
American Record Corp., 549 W. Randolph St., Chicago, Ill.
American Screw Co., 21 Stevens St., Providence, R. I.
● American Steel & Wire Co., 208 S. LaSalle St., Chicago, Ill.
● American Telephone & Telegraph Co., 195 Broadway, New York City.
Amplified Products Co., Box 124, Rodondo, Calif.
Anaconda Wire & Cable Co., 25 Broadway, New York City.
Angell Nail & Chaplet Co., The, 4580 E. 71st St., Cleveland, O.
Angle Steel Stool Co., Inc., 185 Oak St., Plainwell, Mich.
Arnold Co., 210 W. Michigan St., Milwaukee, Wis.
Art Metal Construction Co., Jones & Gifford Sts., Jamestown, N. Y.
Asplundh Tree Expert Co., Glenside, Pa.
● Automatic Electric Co., 1033 W. Van Buren St., Chicago, Ill.
Automatic Electric Co., Ltd., Milton Road, Edgelane, Liverpool, England.
● Automatic Electric Sales Co., Ltd., 1027 W. Van Buren St., Chicago, Ill.
Automatique Electrique de Belgique S. A., 22 rue du Verger, Antwerp, Belgium.
● Autovent Fan & Blower Co., 1811-1821 N. Kostner Ave., Chicago, Ill.
Ayer & Lord Division, The Wood Preserving Corp., 80 E. Jackson Blvd., Chicago, Ill.

B

Babcock, Garrison, 1104 Third Ave., Seattle, Wash.
Bakelite Corp., 247 Park Ave., New York City.
Baker-Raulang Co., The, W. 80th St., Cleveland, O.
● Baker, Walsh & Co., 29 S. LaSalle St., Chicago, Ill.
Baltimore Enamel & Novelty Co., Box 928, Baltimore, Md.
Barber-Greene Co., West Park Ave., Aurora, Ill.
Barnard & Co., B. S., 130 Lafayette St., New York City.
Barnstead Still & Steralizer Co., Inc., Lanesville Terr., Forest Hills, Boston, Mass.
Barrett Bindery Co., The, 1323 W. Monroe St., Chicago, Ill.
Barrett Co., The, 40 Rector St., New York City.
● Bartlett Mfg. Co., 3003 E. Grand Blvd., Detroit, Mich.
● Bartlett Tree Expert Co., Stamford, Conn.
Bashlin, W. M. Inc., Grove City, Pa.
Bates Mfg. Co., The, 30 Vesey St., New York City.
Beatty Directory Co., Geo. F., 912 Pioneer Bldg., St. Paul, Minn.
Beck Duplicator Co., The, 18 W. 18th St., New York City.
Beckman Mfg. Co., Box 85, Lime, O.
Belden Mfg. Co., 4647 W. Van Buren St., Chicago, Ill.
● Bell Lumber & Pole Co., Phoenix Bldg., Minneapolis, Minn.
Benjamin Electric Mfg. Co., DesPlaines, Ill.
Berger Mfg. Co., Canton, O.
Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.
● Berry & Co., L. M., 301-305 Telephone Bldg., Dayton, O.
Berry Solder Co., 19 Rector St., New York City.
Bethlehem Steel Co., 701 E. 3rd. St., Bethlehem, Pa.
Betz Unit Air Cooler Co., 6 W. 9th St., Kansas City, Mo.
Biddle Co., James G., 1211-13 Arch St., Philadelphia, Pa.
B-L Electric Mfg. Co., 19th & Washington Aves, St. Louis, Mo.
Black & Decker, Towson, Md.
● Blackburn Products Corp., Jasper, Main & Clinton Sts., St. Louis, Mo.
Blackburn Specialty Co., 1965 E. 66th St., Cleveland, O.
Block & Co, Lynton T., Chamber of Commerce Bldg., St. Louis, Mo.
Bonbright & Co., 25 Nassau St., New York City.
Bond Bros., 1110 Protective Life Bldg., Birmingham, Ala.
Bond Electric Corp., 257 Cornelison Ave., Jersey City, N. J.
Boom Lake Cedar Co., Rhinelander, Wis.
Boston Woven Hose & Rubber Co., 29 Hampshire St., Cambridge, Mass.
● Bowdle, F. A., 741 Irving Ave., Wheaton, Ill.
● Brach Mfg. Corp., L. S., 80 Duryea St., Newark, N. J.
Brazil Hollow Brick & Tile Co., Brazil, Ind.
Breuer Electric Mfg. Co., 844-856 Blackhawk St., Chicago, Ill.
Bright Star Battery Co., 200 Crooks Ave., Clifton, N. J.
Bristol Co., The, 11 Koester Rd., Waterbury, Conn.
British Insulated Cables, Ltd., Prescot, Lancashire, England.
Brocklen Underground Electric Mfg. Co., Glenside, Pa.
Brockway Motor Co., Inc., Cortland, N. Y.
Brown Co., Portland, Me.
Brown Fence & Wire Co., The, 6520 Juinatia Ave., Cleveland, O.
Brown Wood Preserving Co., Inc., 4th & K Sts., Louisville, Ky.
● Buckeye Telephone & Supply Co., 1432-46 S. Parsons Ave., Columbus, O.

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Buckingnam, W. H., 516 State St., Binghamton, N. Y.
Buda Co., The, Harvey, Ill.
Buhrke Co., R. H., 4538-58 Fullerton Ave., Chicago, Ill.
Burdick Enamel Sign Co., 36 S. State St., Chicago, Ill.
Burgess Battery Co., Box 121, Freeport, Ill.
Burndy Engineering Co., 459 E. 133rd St., New York City.
● Burning Brands Co., 1400 W. Fulton St., Chicago, Ill.
Burroughs Adding Machine Co., 6071 Second Blvd., Detroit, Mich.
Business Building Letterheads, 185 N. Wabash Ave., Chicago, Ill.

C

Calander Mfg. Co., John, 629 Jackson St., St. Paul, Minn.
● Calculagraph Co., 306 Sussex St., Harrison, N. J.
Canadian Telephones & Supplies, Ltd., 284 King St., W., Toronto, Canada.
Carbolineum Wood Preserving Co., 528 W. Highland, Milwaukee, Wis.
● Carney & Co., B. J., 100 N. 7th St., Minneapolis, Minn.
Carrier Engineering Co., 314 W. 10th St., Kansas City, Mo.
Carter Motor Co., 361 W. Superior St., Chicago, Ill.
Cascade Timber Co., Box 1116, Tacoma, Wash.
Caterpillar Tractor Co., Peoria, Ill.
C-A-Wood Preserver Co., 6221 Delmar Blvd., St. Louis, Mo.
Cedar River Lumber Co., Builders' Exchange Bldg., Minneapolis, Minn.
Central Lumber Sales Co., 1022 Terminal Bldg., Lincoln, Neb.
● Chance Co., A. B., Centralia, Mo.
Channell, J. W., 8147 Seville Ave., Southgaite, Calif.
Chapin Cedar Co., 423 Judge Bldg., Salt Lake City, Utah.
Chatillon & Sons, 85-99 Cliff St., New York City.
Chevrolet Motor Co., Detroit, Mich.
Chicago Expansion Bolt Co., 126 S. Clinton St., Chicago, Ill.
Chicago Telephone Supply Co., Elkhart, Ind.
Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill.
● Chisholm-Ryder Co., Inc., Premax Sales Division, College & Highland Aves., Niagara Falls, N. Y.
● Churchill Cabinet Co., 2119 Churchill St., Chicago, Ill.
Cinaudagraph Corp., 2 Selleck St., Stamford, Conn.
Clark Bros. Bolt Co., Milldale, Conn.
Clay Products Co., Brazil, Ind.
Clayton & Lambert Mfg. Co., 11111 French Road, Detroit, Mich.
Clement Co., J. W., Seneca, Lord & Seymour Sts., Buffalo, N. Y.
Cleveland Time Clock & Service Co., 2650 Superior Ave., Cleveland, O.
Cleveland Tractor Co., The, 19300 Euclid Ave., Cleveland, O.
Cleveland Trencher Co., The, 20100 St. Clair St., Cleveland, O.
Cleverly Electrical Works, Inc., 17 N. 7th St., Philadelphia, Pa.
Clow & Sons, James, B., 201 N. Talman Ave., Chicago, Ill.
Clyde Cutlery Co., Clyde, O.
Coffey System & Audit Co., 607 Peoples Bank Bldg., Indianapolis, Ind.
● Coffing Hoist Co., 319 E. Van Buren St., Danville, Ill.
Cohn Bros. Auto Co., 608 N. Capitol Ave., Indianapolis, Ind.
Collins & Co., Thos. E., 1700 Olive St., St. Louis, Mo.
● Communication Equipment & Engineering Co., 504 N. Parkside Ave., Chicago, Ill.
Comstock Cedar & Lumber Co., State Theatre Bldg., Rhinelander, Wis.
Condon Co., Inc., Tarryton Rd., White Plains, N. Y.
Consolidated Molded Products Corp., 309 Cherry St., Scranton, Pa.
Consolidated Motors Corp., Lima, O.
Consolidated Wire & Associated Corporations, 512 S. Peoria St., Chicago. Ill.
Cook, John M., Standard Bldg., Atlanta, Ga.
● Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Cook's Sons, Inc., Adam, 5 Stiles St., Linden, N. J.
Copperweld Co., Glassport, Pa.
Corning Glass Works, Corning, N. Y.
Cottage Planing Mill Co., Everett, Pa.
C-O-Two Fire Equipment Co., Pyrene Bldg., Newark, N. J.
Couch Co., Inc., S. H., North Quincy, Mass.
Cowling, Alfred E., Scotstown, Quebec, Canada.
Crescent Insulated Wire & Cable Co., Taylor & N. Olden Ave., Trenton, N. J.
Crescent Tool Co., 231 Harrison St., Jamestown, N. Y.
Crucible Steel Co. of America, 405 Lexington, New York City.
Cuneo Press, Inc., The, Cermak Road - Canal - Grove Sts., Chicago, Ill.
Curran Corp., The, 115 Central St., Somerville, Mass.
Curran Printing Co., Con. P., 102 S. 8th St., St. Louis, Mo.
Curtin-Howe Corp., 505 Lexington Ave., New York City.
Curtiss Pneumatic Machinery Co., St. Louis, Mo.

D

● Davey Tree Expert Co., Kent, O.
Davis Emergency Equipment Co., 55 Van Dam St., New York City.
Defiance Printing & Engraving Co., 500 Court St., Defiance, O.
Delta Manufacturing Co., 2939 N. Oakley Ave., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., 500 North Ave., Garwood, N. J.
Dick, A. B., 720 W. Jackson Blvd., Chicago, Ill.
Dicke Tool Co., Inc., The, 1201 Warren Ave., Downers Grove, Ill.
● Dillon Mfg. Co., 63 E. Lake St., Chicago, Ill.
Dodge Bros., Inc., 7900 Joseph Campan Ave., Detroit, Mich.
● DoMore Chair Co., Inc., Monger Bldg., Elkhart, Ind.
Donnelley Corp., The Reuben H., 350 E. 22nd St., Chicago, Ill.
Donnelley & Sons Co., R. R., 350 E. 22nd St., Chicago, Ill.
Doubleday-Hill Electric Co., 110 7th St., Pittsburgh, Pa.
Douglas Fir Cross Arm Co., Denver, Colo.
Duff-Norton Mfg. Co., The, Box 1889, Pittsburgh, Pa.
Dunton Co., The M. W., 670 Eddy St., Providence, R. I.
Duo Safety Ladder Corp., 811 9th St., Oshkosh, Wis.
Durabilt Steel Locker Co., Aurora, Ill.

E

Eagle-Picher Sales Co., The, Temple Bar Bldg., Cincinnati, O.
Edison, Inc., Thos. A., Primary Battery Division, Bloomfield, N. J.
Edwards & Co., Inc., 140th & Exterior Sts., New York City.
Electrad, Inc., 175 Varick St., New York City.
● Electric Products Co., 1725 Clarkstone Road, Cleveland, O.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Electric Soldering Iron Co., Inc., 342 W. 14th St., New York City.
Electric Specialty Co., Cresco, Ia.
Electric Specialty Mfg. Co., Box 645, Cedar Rapids, Ia.
● Electric Storage Battery Co., The, Allegheny Ave. & 19th St., Philadelphia, Pa.
Electric Vacuum Cleaner Co., Inc., 1734 Ivanhoe Rd., Cleveland, O.
Electro Engineering Co., Inc., 117-12 Atlantic Ave., Richmond Hill, N. Y.
Electroline Co., 4121 S. LaSalle St., Chicago, Ill.
Electrolux, Inc., New York City.
Elkhart Rubber Works, 1714 13th St., Elkhart, Ind.
Elkin Lumber & Mfg. Co., Elkin, N. C.
Elliott Addressing Machine Co., The, 143 Albany St., Cambridge, Mass.
Emerson Apparatus Co., 171 Tremont St., Melrose, Mass.
Engineering & Management Co., 122 S. Elizabeth St., Lima, O.
Eppinger & Russell Co., 80 8th Ave., New York City.
Eureka Vacuum Cleaner Co., Hamilton St. at Dewey St., Detroit, Mich.
Everstick Anchor Co., The, 9th & Kirkwood Sts., Fairfield, Ia.

F

Fahnestock Electric Co., 141 East Ave., Long Island, N. Y.
Fansteel Metallurgical Corp., 2200 Sheridan Road, North Chicago, Ill.
Federal Motor Truck Co., 5780 Federal Ave., Detroit, Mich.
Felt & Tarrant Mfg. Co., 1735 W. Paulina St., Chicago, Ill.
Fibre Conduit Co., New York City.
Firestone Tire & Rubber Co., Akron, O.
Ford Motor Co., Detroit, Mich.
● Forged Steel Products Co., S. 5th St., New Port, Pa.
Fort Wayne Printing Co., 117 E. Breckenridge St., Fort Wayne, Ind.
Four Wheel Drive Auto Co., E. 12th St., Clintonville, Wis.
Fowle & Co., Frank F., 35 E. Wacker Drive, Chicago, Ill.
Frankel Connector Co., Inc., 177 Hudson St., New York City.
Freuhauf Trailer Co., 10940 Harper Ave., Detroit, Mich.

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G

Gamewell Co., The, Newton, Mass.
● Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, Ill.
Gardner-Denver Co., Gardner & Front St., Quincy, Ill.
General Cable Corp., 420 Lexington Ave., New York City.
General Dry Batteries, Inc., 13100 Athens Ave., Cleveland, O.
General Electric Co., 1285 Boston Ave., Bridgeport, Conn.
General Electric Co., Ltd., The, Telephone Works, Coventry, England.
General Motors Truck Co., Detroit, Mich.
General Office Equipment Co., New York City.
General Radio Co., 30 State St., Cambridge A, Mass.
General Telephone Directory Co., 122 W. Washington Ave., Madison, Wis.
Gilkey-Brown Cedar Co., 954 McKnight Bldg., Minneapolis, Minn.
Globe-Wernicke Co., The, Ross & Carthage Aves., Cincinnati, O.
Glyco Products Co., Inc., 949 Broadway, New York City.
Goodrich Co., The, B. F., 426 S. Main St., Akron, O.
Goodyear Tire & Rubber Co., Inc., Akron, O.
Gotfredson Corp., Detroit, Mich.
● Gould Storage Battery Corp., 35 Neoga St., Depew, N. Y.
Graveley, B. F. & R. P., Martinsville, Pa.
Graves Co., C. H., 1518 Chestnut St., Philadelphia, Pa.
● Graybar Electric Co., 420 Lexington Ave., New York City.
Gray Instrument Co., 64½ W. Johnson St., Philadelphia, Pa.
Gray Telephone Pay Station Co., 16-30 Arbor St., Hartford, Conn.
Greenlee Bros. & Co., 12th St., Rockford, Ill.
Grobet File Corp. of America, 3 Park Place, New York, N. Y.
Guardian Electric Mfg. Co., 1621 Walnut St., Chicago, Ill.
Gulfport Creosoting Co., Gulfport, Miss.
Gulf States Creosoting Co., W. Pine St., Hattiesburg, Miss.

H

● Habirshaw Cable & Wire Corp., Div. Phelps Dodge Copper Prod. Corp., 40 Wall St., New York City.
Hallett Iron Works, 14635 Lincoln St., Harvey, Ill.
Harrah Mfg. Co., Bloomfield, Ind.
Haskins Co., R. G., 4636 W. Fulton St., Chicago, Ill.
Hatheway Patterson Corp., 220 Church St., New York City.
Hazard Insulated Wire Works, Div of Okonite Co., 70-72 Hazle St., Wilkes-Barre, Pa.
● Hemingray Division, Owens-Illinois Glass Co., Macedonia Ave., Muncie, Ind.
● Herdich & Boggs, 803 Electric Bldg., Indianapolis, Ind.
Hexacon Electric Appliance Corp., 161-163 W. Clay St., Roselle Park, N. J.
Heywood-Wakefield Co., 174 Portland, Boston, Mass.
High Tension Co., Inc., The, 36 N. Main St., Phillipsburg, N. J.
Highway Trailer Co., Edgerton, Wis.
Hipwell Mfg. Co., 825-835 W. North Ave., N. S., Pittsburgh, Pa.
Hirsch, Gustav, 209 S. 3rd St., Columbus, O.
● Holtzer-Cabot Elec. Co., The, 125 Amory St., Boston, Mass.
Homelite Corp., Riverdale Ave., Port Chester, N. Y.
Hope Webbing Co., Inc., 1005 Main St., Pawtucket, R. I.
Hoppe Engineering Co., A. F., 107 S. Capitol Ave., Indianapolis, Ind.
Hubbard & Co., 6301 Butler St., Pittsburgh, Pa.
Hughes Bros., Seward, Neb.
Hurt & Co., Ferrum, Va.
Hydrauger Corp., 116 New Montgomery St., San Francisco, Calif.
Hygrade Sylvania Corp., 60 Boston St., Salem, Mass.

I

Ideal Commutator Dresser Co., 1064 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., The, E. 1st & Oak Sts., Mansfield, O.
Ideal Products Co., 17 Leonard St., N. E., Grand Rapids, Mich.
Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago, Ill.
● Independent Cord Co., Temple St.. Framingham, Mass.
Independent Telephone Repair Co., 1432 W. 15th St., Chicago, Ill.
Indiana Oxygen Co., 437 S. Delaware St., Indianapolis, Ind.
● Indiana Steel & Wire Co., Muncie, Ind.
Ingram Richardson Mfg. Co., Beaver Falls, Pa.
Insulated Steel Construction Co., Middletown, O.
Insulation Mfg. Co., Inc., New York & Herkimer Sts., Brooklyn, N. Y.
International Creosoting & Construction Co., 2205½ Ave. B., Galveston, Tex.
International Electric & Mfg. Co., The, 1802 E. 39th St., Kansas City, Mo.
International Harvester Co. of America, 606 S. Michigan Ave., Chicago, Ill.
International Resistance Co., 2100 Arch St., Philadelphia, Pa.
Invincible Vacuum Cleaner Mfg. Co., 14th & Davis Sts., Dover, O.
Iron Products Corp., LaCrosse, Wis.
Iwan Bros., 1503 Prairie Ave., South Bend, Ind.

J

Jackson Lumber Co., Lockhart, Ala.
Jentz Cedar Co., W. Winnebago & Isinwood Ave., Appleton, Wis.
Johns-Manville, 22 E. 40th St., New York City.
Johnson Mfg. Co., 729 W. Washington Blvd., Chicago, Ill.
Jordon Bros. Lumber Co., Box 1384, Norfolk, Va.
Joslyn Mfg. & Supply Co., 20 N. Wacker Drive, Chicago, Ill.
Joyce-Cridland Co., The, 519 N. Findlay St., New York City.
Joyce-Watkins Co., 400 W. Madison St., Chicago, Ill.

K

Kaul Clay Mfg. Co., Toronto, O.
Kearney Corp., James R., 4224 Clayton Ave., St. Louis, Mo.
Kellems Products, Inc., 100 Lafayette St., New York City.
● Kellogg Switchboard & Supply Co., 1066 W. Adams St., Chicago, Ill.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
● Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Keystone Steel & Wire Co., Peoria, Ill.
Kidde & Co., Inc., Walter, 10 West St., Bloomfield, N. J.
● Klein & Sons, Mathias, 3200 Belmont Ave., Chicago, Ill.
Kraeuter & Co., 563 18th Ave., Newark, N. J.

L

Lanz Bolt Co., M., 2907 E. Carson St., Pittsburgh, Pa.
● Larkin & Co., John C., 409 Chamber of Commerce Bldg., Syracuse, N. Y.
Leach Co., 412 S. Main St., Oshkosh, Wis.
Leach Relay Co., 5915 Avalon Blvd., Los Angeles, Calif.
Leadclad Wire Co., Moundsville, W. Va.
Leavitt-Naugle Co., 205 W. Wacker Drive, Chicago, Ill.
LeCarbone Co., Inc., Myrtle Ave., Boonton, N. J.
Leeds & Northrup Co., 4946 Stenton Ave., Philadelphia, Pa.
● Leich Electric Co., Genoa, Ill.
● Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lewis Bolt & Nut Co., 504 Malcolm Ave.. S. E., Minneapolis, Minn.
Liberty Mutual Insurance Co., 31 St. James Ave., Boston, Mass.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
Line Material Co., South Milwaukee, Wis.
Linemen's Specialty Co., Jackson St., Mason City, Ia.
● Linzer & Sons, David, 10 Astor Place, New York City.
Littleford Bros., 451 E. Pearl St., Cincinnati, O.
Littelfuse Laboratories, 4507 Ravenswood Ave., Chicago, Ill.
Locke Insulator Corp., S. Charles & Cromwell Sts., Baltimore, Md.
Locust Pin Co., Inc., Front Royal, Va.
Long-Bell Lumber Sales Corp., R. A. Long Bldg., Kansas City, Mo.
Loomis Advertising Co., Telephone Bldg., Kansas City, Mo.
● Lorain Products Corp., 671 Broadway, Lorain, O.
Lyon Metal Products, Inc., 635 Madison Ave., Aurora, Ill.

M

MacDonald & Co., T. L., 29 Broadway, New York City.
● MacGillis & Gibbs Co., The, 324 E. Wisconsin Ave., Milwaukee, Wis.
Mack Trucks, Inc., 25 Broadway, New York City.
Malleable Iron Fittings Co,. 30 Church St., New York City.
● Malloy Mfg. Co., 2113 Oakridge Ave., Madison, Wis.
Marathon Battery Co., Wausau, Wis.
Marchant Calculating Machine Co., 1475 Powell St., Oakland, Calif.

● Advertisement in this issue—See Index to Advertisers, Page 106

Martindale Electric Co., The, 1392 Hird Ave., Lakewood, Cleveland, O.
Martin-Decker Corp., Long Beach, Calif.
Mathias-Hart Co., 5 Whitney Place, Ampere, N. J.
Matthews & Co., Jas. H., 3942 Forbes St., Pittsburgh, Pa.
● Matthews Corp., W. N., 3722 Forest Park Blvd., St. Louis, Mo.
Medart Mfg. Co., Fred, Potomac & DeKalb Sts., St. Louis, Mo.
Meredith Co., William C., Station A, Atlanta, Ga.
Metalweld Inc., 26th & Huntingtonpark Ave., Philadelphia, Pa.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
● Michigan Pole & Tie Co., 930 Grand Rapids Nat'l Bank Bldg., Grand Rapids, Mich.
Miller Co., The, Meriden, Conn.
Miller Lumber Co., J. W., 301 Lumber Exchange, Minneapolis, Minn.
Milligan & Wright Co., 1243 W. 3rd St., Cleveland, O.
Minerallac Electric Co., 25 N. Peoria St., Chicago, Ill.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.
Minneapolis Electric & Construction Co., 80 S. 12th St., Minneapolis, Minn.
Mitchell-Rand Insulation Co., The, 51 Murray St., New York City.
Monroe Calculating Machine Co., Inc., 555 Mitchell St., Orange, N. J.
Morlen Electric Co., New York City.
Morley Button Mfg. Co., 865 Islington St., Portsmouth, N. H.
Moss Tie Co., Security Bldg., St. Louis, Mo.
Mueller Electric Co., 1583 E. 31st St., Cleveland, O.
Muter Co., The, 1255 S. Michigan Ave., Chicago, Ill.

Mc

McCabe-Powers Auto Body Co., 1213-23 N. Broadway, St. Louis, Mo.
McDowell Mfg. Co., Millvale Station, Pittsburgh, Pa.
McEvoy, C. R., Lowell, Mass.
McIntyre Connector Co., Jefferson & Chestnut Sts., Newark, N. J.
McMillen, W. L., Osborn, Kans.

N

● National Carbon Co., 30 E. 42nd St., New York City.
Nation Electric Products Corp., 12th Floor, Fulton Bldg., Pittsburgh, Pa.
National Electric Specialty Co., The, 314 S. St. Clair St., Todelo, O.
National Engineering & Construction Co., 1031 W. Van Buren St., Chicago, Ill.
National Fireproofing Corp., 202 E. Ohio St., N. S., Pittsburgh, Pa.
National Lead Co., 111 Broadway, New York City.
National Lumber & Creosoting Co., State Nat'l Bank Bldg., Texarkana, Ark.
National Pole & Treating Co., 1100 Builders' Exchange, Minneapolis, Minn.
National Specialties Co., 1902 Howell St., Fort Wayne, Ind.
National Telephone Directory Co., 9th & Walnut Sts., St. Louis, Mo.
● National Telephone Supply Co., The, 5100 Superior Ave., Cleveland, O.
Naugle Pole & Tie Co., 5 S. Wabash Ave., Chicago, Ill.
Nelson & Kuemmerling, Inc., 1703 Tuscarawas W., Canton, O.
Niedermeyer-Martin Lumber Co., Spaulding Bldg., Portland, Ore.
Norfolk Creosoting Co., Box 28, Norfolk, Va.
Noris Carbon Co., Inc., 160 5th Ave., New York City.
North Bros. Mfg. Co., Lehigh Ave. & American St., Philadelphia, Pa.
● North Electric Mfg. Co., The, Galion, O.
Northern Electric Co., 2835 N. Western Ave., Chicago, Ill.
Northwestern Clock Co., The, 514 Brown Bldg., Omaha, Neb.
Novo Engine Co., Lansing, Mich.

O

Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh, Pa.
Omaha Standard Body Corp., 2411 W. Broadway, Council Bluffs, Ia.
Oneida Cedar & Lumber Co., Rhinelander, Wis.
Osmose Corp. of America, 25 E. Huron St., Buffalo, N. Y.
● Owens-Illinois Glass Co., Hemingray Division, Macedonia Ave., Muncie, Ind.

P

Padua Hold-Up Alarm Co., Inc., Seneca St., Cohoes, N. Y.
Page & Hill Co., 1320 Northwestern Bank Bldg., Minneapolis, Minn.
Page Steel & Wire Division of American Chain Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.
Paine Co., 2951 Carroll Ave., Chicago, Ill.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Parker Brothers & Co., Littleton, N. H.
Parker-Kalon Corp., 200 Varick St., New York City.
● Partridge Lumber Co., T. M., 731 Lumber Exchange, Minneapolis, Minn.
● Pearl Co., Wm. H., 260 Transportation Bldg., Indianapolis, Ind.
Pease Co., C. F., 804 N. Franklin St., Chicago, Ill.
Peiffer, P., 6 Columbia St., Newark, N. J.
Pensacola Creosoting Co., Pensacola, Fla.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Phillips Electrical Works, Ltd., Eugene F., Brockville, Ontario.
Phono-Print Co., The, 500 Court St., Defiance, O.
Pioneer Gen-E-Motor Corp., 466 W. Superior St., Chicago, Ill.
Pirelli General Cable Works, Ltd., Southampton, England.
Plumb, Fayette P., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, O.
Porcelain Products, Inc., Camden Ave., S. S., Parkersburg, W. Va.
Porter, Inc., H. K., 6 Ashland St., Everett, Mass.
Port Royal Pin Mill, Port Royal, Pa.
Postal Telegraph Co., 67 Broad Street, New York City.
Potosi Tie & Lumber Co., 1801 Allen Bldg., Dallas, Tex.
● Premax Sales Div., Chisholm-Ryder Co., Inc., College & Highland Aves, Niagara Falls, N. Y.
Providence Insulated Wire Co., 58 Waldo St., Providence, R. I.
Putnam & Co., Inc., 32 Howard St., New York City.
Pyramid Products Co., 2309 S. State St., Chicago, Ill.
Pyrene Mfg. Co., 560 Belmont Ave., Newark, N. J.

R

Railroad Repair & Supply Co., 203 S. Dearborn St., Chicago, Ill.
Rawlplug Co., Inc., The, 98 Lafayette St., New York City.
● Ray-O-Vac Co., 2319 Winnebago St., Madison, Wis.
Raytheon Production Corp., 55 Chapel St., Newton, Mass.
Read, Walter V., 11 Park Place, New York City.
● Ready Mfg. Co., 608 Security Bank Bldg., Toledo, O.
● Rebuilt Electric Equipment Co., 1940 W. 21st St., Chicago, Ill.
Red Devil Mfg. Co., Bellwood, Ill.
● Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Remington Rand, Inc., 465 Washington St., Buffalo, N. Y.
Reo Motor Car Co., S. Washington Ave., Lansing, Mich.
Republic Cedar Co., Marinette, Wis.
Republic Creosoting Co., 1614 Merchants Bank Bldg., Indianapolis, Ind.
Rhodes & Sons Co., M. M., 12 Porter St., Taunton, Mass.
Roebling's Sons Co., J. A., Trenton, N. J.
Roller-Smith Co., 233 Broadway, New York City.
Ruberoid Co., The, 500 Fifth Ave., New York City.
Rudisill Electric Service Co., Kincaid, Kans.
● Runzel Cord & Wire Co., 4727-31 Montrose Ave., Chicago, Ill.
● Russell, C. B., 213 Interurban Terminal Bldg., Columbus, O.

S

Salisbury & Co., W. H., 401 N. Morgan St., Chicago, Ill.
Samson Mfg. Co., 603 S. Main St., Centerville, Ia.
Savannah Creosoting Co., Savannah, Ga.
Schauer Machine Co., The, 905 Broadway, Cincinnati, O.
Schollhorn Co., The Wm., 414 Chapel St., New Haven, Conn.
Schramm, Inc., West Chester, Pa.
Scoville Timber Co., 202 Scott Block, Winnipeg, Manitoba, Canada.
Screw Machine Products Corp., The, 1012 Eddy St., Providence, R. I.
Seeger Device Co., 2115 Smead Ave., Toledo, O.
Select-O-Phone Co., The., 1012 Eddy St., Providence, R. I.
Self Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago, Ill.

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Sequin Co., Ltd., Box 2530, Montreal, Canada.
Service Recorder Co., The, 1422 Euclid Ave., Cleveland, O.
● Seymour Smith & Son, Inc., Oakville, Conn.
● Shallcross Mfg. Co., 700 McDade Blvd., Collingale, Pa.
Shaw Insulator Co., 150 Coit St., Irvington, N. J.
Shawmut Clay Mfg. Co., St. Marys, Pa.
Sherman Mfg. Co., H. B., 22 Barney St., Battle Creek, Mich.
Sherron Metallic Corp., 1201 Flushing Ave., Brooklyn, N. Y.
Siemens Brothers & Co., Ltd., Woolwich, London, England.
Siemon Co., Bridgeport, Conn.
Sigalet & Co., Ltd., H., Lumby, B. C., Canada.
Signal Engineering & Mfg. Co., 154 W. 14th St., New York City.
Signaphone Corp. of America, 405 Lexington Ave., New York City.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge A, Boston, Mass.
Smith Co., T. L., Milwaukee, Wis.
Snell Mfg. Co., Fiskdale, Mass.
Snook, Martin & Co., Columbus, O.
Sound Engineering Corp., 412 N. Leavitt St., Chicago, Ill.
South Bend Lathe Works, 718 E. Madison St., South Bend, Ind.
Southern Wood Preserving Co., Atlanta, Ga.
Sparta Mfg. Co., Muskegon, Mich.
S. P. A. Truck Corp., South Bend, Ind.
Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.
Specialty Device Co., The, 106 W. 103rd St., Cincinnati, O.
Speer Carbon Co., St. Marys, Pa.
Spencer Lens Co., 19 Doat St., Buffalo, N. Y.
S. P. F. Wood-Preserving Co., Inc., Kindall Square Bldg., Boston, Mass.
Square D Co., 6060 Rivard St., Detroit, Mich.
Stackpole Carbon Co., St. Marys, Pa.
Standard Cedar Co., Lumber Exchange Bldg., Minneapolis, Minn.
Stanley & Patterson, Inc., 150 Varick St., New York City.
Star Bit & Tool Co., Rockford, Ill.
Star Expansion Bolt Co., 147 Cedar St., New York City.
Steel & Tubes, Inc., 224 E. 131 St., Cleveland, O.
Stephenson Engineering Co., 303 W. Genesse St., Auburn, N. Y.
● Stewart Bros., Ottawa, Ill.
Sticht & Co., Herman H., 27 Park Place, New York City.
Stone Paper Tube Co., 900-922 Franklin St., N. E., Washington, D. C.
● Stromberg-Carlson Telephone Mfg. Co., 100 Carlson Rd., Rochester, N. Y.
Stromberg Electric Co., 223 W. Erie St., Chicago, Ill.
Struthers Dunn, Inc., 139 N. Juniper St., Philadelphia, Pa.
Stubbs Electric Co., Park & Couch Sts., Portland, Ore.
● Sturgis Posture Chair Co., Sturgis, Mich.
Sundt Engineering Co., 4238 Lincoln Ave., Chicago, Ill.
● Suttle Equipment Co., Lawrenceville, Ill.
Synthane Corp., Oaks, Pa.
Synthetic Mould Products, Inc., Stonington, Conn.

T

Tavella Sales Co., 25 W. Broadway, New York City.
Taylor-Colquitt Co., Spartansburg, S. C.
Telefon Fabrik Automatic, 7, Amaliegade, Copenhagen, Denmark.
Telefonaktiebolaget L. M. Ericsson, Dabelnsgatan, 18, Stockholm, Sweden.
Tele-Pak Co., 514 N. Prior St., St. Paul, Minn.
Telephonads, 205 W. Wacker Drive, Chicago, Ill.
Telephone Construction & Distributing Co., Petersburg, Ind.
● Telephone Engineer Publishing Co., 185 N. Wabash Ave., Chicago, Ill.
Telephone Equipment Co., 88 Park Place, New York City.
● Telephone Repair Shop, The, 1760 Lunt Ave., Chicago, Ill.
Teletype Corp., 1400 Wrightwood Ave., Chicago, Ill.
● Telkor, Inc., 161 Ridge St., Elyria, O.
Templeton, Kenley & Co., Ltd., 1020 S. Central Ave., Chicago, Ill.
Texas Creosoting Co., Orange, Tex.
Thomas & Sons Co, The R., Libson, O.
● Thompson Co., The, 260 N. Lawrence St., Philadelphia, Pa.
Tinius Olsen Testing Machine Co., Philadelphia, Pa.
Toledo Pressed Steel Co., 397 Phillips Ave., Toledo, O.
Trackson Co., 3333 S. Chase Ave., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Trent Co., Harold E., 618-40 N. 54th St., Philadelphia, Pa.
Turner Brass Works, The, Sycamore, Ill.
Tuttle & Bailey, Inc., New Britian, Conn.

U

Underwood Elliott Fisher Co., 342 Madison Ave., New York City.
Union Electric Co., 1165 E. 30th St., Indianapolis, Ind.
● Unique Mfg. Co., Inc., 221 Whiting St., Chicago, Ill.
United States Rubber Co., 1790 Broadway, New York City.
Universal Battery Co., 3410 S. LaSalle St., Chicago, Ill.
Universal Specialty Co., 711 Poplar St., Terre Haute, Ind.
USL Battery Corp., Highland Ave., Niagara Falls, N. Y.
U. S. Tent & Awning Co., 701-09 N. Sangamon St., Chicago, Ill.
Utilities Service Co., Inc., Box 627, Allentown, Pa.
Utility Supply Co., E. 12th St., Clintonville, Wis.
Utility Trailer Mfg. Co., Box 1407 Arcade Annex, Los Angeles, Calif.

V

● Valentine Clark Corp., 2516 Doswell Ave., St. Paul, Minn.
Van Cleef Bros., Woodlawn Ave., 77th to 78th Sts., Chicago, Ill.
Van Pragg Corp., 22 E. 17th St., New York City.
Veeder-Root, Inc., Garden & Sargeant Sts., Hartford, Conn.
Victor Adding Machine Co., 3900 N. Rockwell St., Chicago, Ill.
Vreeland, B. F., 515 Boston Bldg., Denver, Colo.
Vulcan Electric Co., 600 Broad St., Lynn, Mass.
Vulcan Electric Heater Corp., 225 Varick St., New York City.

W

Wall Mfg. Supply Co., P., 3126-66 Preble Ave., Pittsburgh, Pa.
Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Warren Mfg. Co., J. D., 1954 Ivy St., Montpelier, O.
Waterbury Battery Co., The, 1036 S. Main St., Waterbury, Conn.
Weber Bros. Metal Works, 108-28 N. Jefferson St., Chicago, Ill.
Welker, J. H., McKinley Block, Canton, O.
Western Block Co., Lockport, N. Y.
● Western Electric Co., Inc., 195 Broadway, New York City.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J.
Weyerhaeuser Pole Co., 1860 Rand Tower, Minneapolis, Minn.
Whitall Tatum Co., 225 Varick St., New York City.
White Co., The, St. Clair & E. 79th St., Cleveland, O.
● Whitney Blake Co., The, P. O. Drawer K, Hamden, Conn.
Wilkinson Lumber Co., Allen A., 907 E. Michigan St., Indianapolis, Ind.
Willard Storage Battery Co., 246-86 E. 131st St., Cleveland, O.
Williams, George E., Mfg., 811 W. Lake St., Minneapolis, Minn.
Wing Mfg. Co., L. J., 154 W. 14th St., New York City.
Wisconsin Cuneo Press, Inc., 4400 N. Port Washington Road, Milwaukee, Wis.
● Wodack Electric Tool Corp., 4637 W. Huron St., Chicago, Ill.
Wolf Safety Lamp Co. of America, Inc., 68-72 Emerson Place, Brooklyn, N. Y.
Wood Industries, Inc., Gar, 7924 Riopelle St., Detroit, Mich.
Wood Preserving Corp., The, Koppers Bldg., Pittsburgh, Pa.
● Wopat, J. W., 303 E. Berry St., Fort Wayne, Ind.
● Wray & Co., J. G., 105 W. Adams St., Chicago, Ill.
Wright, Inc., L. G., 5713-15 Euclid Ave., Cleveland, O.
Wrought Washer Mfg. Co., 2222 S. Bay St., Milwaukee, Wis.
Wycoff Pipe & Creosoting Co., Inc., 522 Fifth Ave., New York City.

Y

Yale & Towne Mfg. Co., The, Philadelphia Div., 4530 Tacony St., Philadelphia, Pa.
Yawman & Erbe Mfg. Co., 1099 Jay St., Rochester, N. Y.
York-Hoover Body Corp., Linden & Belvidere Aves., York, Pa.

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Telephone Engineer
1937 DIRECTORY NUMBER
• SECTION 3 --- TRADE NAMES •

A

ABC—Cable splicing machines, sleeve machines. Jas. R. Kearney Corp., St. Louis, Mo.

ACCO—Pole jacks. American Chain Co., Inc., Bridgeport, Conn.

Accurate—Anti-freeze fire extinquishers. Pyrene Mfg. Co., Newark, N. J.

Acidseal—Rubber compounds. The B. F. Goodrich Co., Akron, O.

Acme—Index card systems. Acme Card System Co., Chicago, Ill.

AD—Dry cell and primary batteries. LeCarbone Co., Inc., Boonton, N. J.

Addressellott — Addressing machines. The Elliott Addressing Machine Co., Cambridge, Mass.

Addressograph — Addressing machines, Addressograph - Multigraph Corp., Cleveland, O.

Airco--Nitrogen and torches. Air Reduction Sales Co., New York City.

Albany Improved—Cable pulling compound. Adam Cook's Sons, Inc., Linden, N. J.

Alcoa—Aluminum conduit, fuse wire, pole identification tags. Aluminum Co. of America, Pittsburgh, Pa.

Alisco—Guy and screw anchors. The High tension Co., Inc., Phillipsburg, N. J.

Allen—Test clips and clamps, solderless wire connectors. Cleverly Electrical Works, Inc., Philadelphia, Pa.

Allsteel—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Allsafe—Belts and safety straps, linemen's gloves, ladders and ladder mounts and safety first equipment. American Allsafe Co., Buffalo, N. Y.

Always Reliable—Fire pots and furnaces, melting pots, solder pots; alcohol, brazing, gasoline, and soldering torches; wiping cloths. Otto Bernz Co., Inc., Rochester, N. Y.

Amcreco—Deadmen, southern yellow pine poles. American Cresoting Co., Louisville, Ky.

Amelectric—Wire. Kennecott Wire & Cable Co., Phillipsdale, R. I.

American Beauty—Soldering irons and pots. American Electrical Heating Co., Detroit, Mich.

Angstrom—Blueprint lamps. Milligan and Wright Co., Cleveland, O.

Anhydrex—Rubber covered and submarine cables. Simplex Wire & Cable Co., Boston, Mass.

Anode—Linemen's gloves. The B. F. Goodrich Co., Akron, O.

Anvil—Tackle blocks. Western Block Co., Lockport, N. Y.

Argon—Neon lightning arresters. L. S. Brach Mfg. Corp., Newark, N. J.

Arm Dependable—Crossarms. American Cross-Arm, Inc., Jacksonville, Fla.

Armored Kathanode—Storage batteries. Gould Storage Battery Corp., Depew, N. Y.

A-S-E—Filing cabinets, lockers, tool boxes. All-Steel-Equipment Co., Aurora, Ill.

ATEA—Bells, cords, dials, electrical measuring instruments, switchboard plugs, receivers, switchboards, telephones, wire. Automatic Electrique de Belgique, Antwerp, Belgium.

Atlas—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Autelco—Battery charging equipment, magneto bells, cable racks, paging systems, coils, condensers, switchboard counters, dials, receiver head bands, lamps, mouthpieces, pay station telephones, switchboard plugs, public address systems, receivers, rectifiers, extension relays, resistors, ringers, ringing machines, signal systems, switchboards, telephone instruments, time recorders, transmitters. Automatic Electric Co., Chicago, Ill.

Autelco-Sanda — Protective Equipment, complete. Automatic Electric Co., Chicago, Ill.

Autovent—Propeller fans, louvres & unit heaters. Autovent Fan & Blower Co., Chicago, Ill.

Avenarius Carbolineum — Carbolineum wood preservatives. Carbolineum Wood Preserving Co., Milwaukee, Wis.

B

Baker—Tractors, tree trimming equipment, truck bodies. The Baker-Raulang Co., Cleveland, O.

Balkite — Battery chargers, rectifiers, condensers. Fansteel Metallurgical Corp., North Chicago, Ill.

Barnstead — Water stills. Barnstead Still & Steralizer Co., Inc., Forest Hills, Boston, Mass.

Barrett—Cable reel jacks. The Duff-Norton Mfg. Co., Pittsburgh, Pa.

Barthel—Fire pots and furnaces; alcohol, brazing, gasoline blow and soldering torches. Van Praag Sales Corp., New York City.

Bartlett — Tree trimming equipment. Bartlett Mfg. Co., Detroit, Mich.

Bee Line—Bond wires and plates, cable racks, conduit tools, soldering flux, cable reel jacks, conduit, ground rods. Brocklen Underground Electric Mfg. Co., Glenside, Pa.

Bernard—Office furniture and pliers. The Wm. Schollhorn Co., New Haven, Conn.

Bethanized—Wire. Bethlehem Steel Co., Bethlehem, Pa.

Betz—Air conditioning equipment. Betz Unit Air Cooler Co., Kansas City, Mo.

B. I. — Lightning arresters, primary batteries, cable boxes, cable, cable racks, cable rollers, cable and pothead compounds, condensers, telephone and switchboard cords, meters, cable grips, molded insulation, cable reel jacks, manhole covers and frames, bar solder, knife switches, insulating tape, cable splicers' tents, wire. British Insulated Cables, Inc., Prescot, Lancashire, England.

Bierce—Guy anchors, cable rollers, guy wire guards. The Specialty Device Co., Cincinnati, O.

BLA—Wood anchors. Texas Creosoting Co., Orange, Tex.

Black Beauty — Crossarms, deadmen, pine poles. Texas Creosoting Co., Orange, Tex.

Blackburn—Hoists, toll ticket carriers, linemen's spur gauges. Jasper Blackburn Products Corp., St. Louis, Mo.

Blackburn—Ground clamps. Blackburn Specialty Co., Cleveland, O.

Black & Decker—Electric drills, melting pots, screwdrivers. The Black & Decker Mfg. Co., Towson, Md.

Blake—Insulated staples. S. H. Couch Co., Inc., North Quincy, Mass.

Bon-Air—Telephone booth ventilators and air conditioning equipment. Stephenson Engineering Co., Auburn, N. Y.

Brach — Binding posts, fuse blocks, ground cones. L. S. Brach Mfg. Corp, Newark, N. J.

Break-Type—Splicing clamps. The High Tension Co., Inc., Phillipsburg, N. J.

Bright Star—Dry cell batteries, flash lights. Bright Star Battery Co., Clifton, N. J.

Brocklen—Cable hangers. Brocklen Underground Electric Mfg. Co., Glenside, Pa.

Brockway — Motor trucks, tractors, truck bodies. Brockway Motor Truck Co., Inc., Cortland, N. Y.

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Buckingham—Belts, safety straps. W. H. Buckingham, Binghamton, N. Y.

Bull Dog—Friction and insulating tape. Boston Woven Hose and Rubber Co., Cambridge, Mass.

Burroughs—Adding machines, calculating machines, operators' chairs, typewriters. Burroughs Adding Machine Co., Detroit, Mich.

C

C-A—(Carbolineum America) Carbolineum wood preservatives. C-A Wood Preserver Co., St. Louis, Mo.

Calculagraph—Time recording instruments. Calculagraph Co., Harrison, N. J.

Campbell—Cable reel jacks. American Chain Co., Inc., Bridgeport, Conn.

Candohms—Resistors. The Muter Co., Chicago, Ill.

Carbosota—Wood preservatives. The Barrett Co., New York City.

Cardvertiser — Addressing machines. The Elliott Addressing Machine Co., Cambridge, Mass.

CertiFile—Filing cabinets. Remington Rand, Inc., Buffalo, N. Y.

Challenger—Twin lever spur gear gravity lowering hoists. Coffing Hoist Co., Danville, Ill.

Champion—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Channell—Cable benders, splicing machines. J. W. Channell, Southgate, Calif.

Chicago—Cable and wire grips. Mathias Klein & Sons., Chicago, Ill.

Churchill—Telephone booths and telephone booth ventilators. Churchill Cabinet Co., Chicago, Ill.

Clam Pipe—Ground clamps. Mueller Electric Co., Cleveland, O.

Cletrac—Crawler tractors. The Cleveland Tractor Co., Cleveland, O.

Cleveland — Tamper backfillers. The Cleveland Trencher Co., Cleveland, O.

Cleverly—Ground clamps. Cleverly Electrical Works, Inc., Philadelphia, Pa.

Coffing — Ratchet and chain hoists. Coffing Hoist Co., Danville, Ill.

Columbia Gray Label—Dry cell batterries, National Carbon Co., New York City.

Columbus—Digging tools, deadmen, pike poles, pole hole diggers, pole supports, pay-out and take-up reels and tree trimming equipment. The American Fork & Hoe Co., Cleveland, O.

Comfo—First aid equipment and respirators. Mine Safety Appliances Co., Pittsburgh, Pa.

Comptometer—Adding and calculating machines. Felt & Tarrant Mfg. Co., Chicago, Ill.

Conneaut—Telephone spoons and shovels. American Fork and Hoe Co., Cleveland, O.

Con-Nec-Tites — Solderless wire connectors. Jas. R. Kearney Corp., St. Louis, Mo.

Copperweld — Ground clamps, cable hangers and rings, nails, anchor and ground rods, wire sleeves, staples, guy and messenger strand, wire. Copperweld Steel Co., Glassport, Pa.

Coraline—Soldering flux. British Inslated Cables, Ltd., Prescot, Lancashire, England.

Cotelco—Annunciators. S. H. Couch Co., Inc., North Quincy, Mass.

C-O-Two—Fire extinguishers. C-O-Two Fire Equipment Co., Newark, N. J.

C-R—Solderless wire connectors, contact cleaners. Electric Specialty Mfg. Co., Cedar Rapids, Ia.

Crapo—Guy and messenger strand, open galvanized steel and tie wire. Indiana Steel & Wire Co., Muncie, Ind.

Crescent—Splicing clamps; cable connectors; cable and wire grips; pliers and wire cutters; screwdrivers; sleeve tools and wrenches. Crescent Tool Co., Jamestown, N. Y.

Crestology—Pliers and wire cutters and wrenches. Crescent Tool Co., Jamestown, N. Y.

Crosby—Cable clamps, cable and wire rope clips. American Hoist & Derrick Co., St. Paul, Minn.

Cushioner—Operators' chairs. Remington Rand, Inc., Buffalo, N. Y.

D

Delta—Telephone booths, boxes; cabinets, telephone, switchboard; signs, advertising and display, warning. Delta Mfg. Co., Chicago, Ill.

Delta—Radio equipment. Raytheon Production Corp., Newton, Mass.

Deltaheston—Lead encased, rubber covered and switchboard cable; telephone and switchboard cords, magnet and switchboard wire. General Electric Co., Bridgeport, Conn.

Diamond — Expansion bolts, cable clamps, hand drills, toggle bolts, screws. Diamond Expansion Bolt Co., Inc., Garwood, N. J.

Dicke — Crow, digging and tamping bars, conduit tools, digging tools, wire and cable grips, pay-out and take-up reels, conduit rods, pike poles, pole supports. The Dicke Tool Co., Downers Grove, Ill.

Diverter Pole — Telephone battery charger. The Electric Products Co., Cleveland, Ohio.

DoMore — Office furniture, operators' chairs. DoMore Chair Co., Inc., Elkhart, Ind.

Dreadnaught—Storage batteries. Gould Storage Battery Corp., Depew, N. Y.

Dreadnaught—Fire pots and furnaces, gasoline - blow, kerosene - blow torches; compound kettles. P. Wall Mfg. Supply Co., Pittsburgh, Pa.

Duff-Norton—Pole jacks. The Duff-Norton Mfg. Co., Pittsburgh, Pa.

Dunco—Ladles, melting pots and relays. Struthers Dunn, Inc., Philadelphia, Pa.

Duo-Safety—Ladders. Duo Safety Ladder Corp., Oshkosh, Wis.

Durabilt—Steel lockers. Durabilt Steel Locker Co., Aurora, Ill.

Duragarde—Anti-freeze type fire extinguishers. Pyrene Mfg. Co., Newark, N. J.

Durasote—Wood preservatives. Page & Hill Co., Minneapolis, Minn.

Duro-Power—Dry cell batteries. General Batteries, Inc., Cleveland, O.

Dutch Brand—Soldering flux; friction, insulating and coil tape. Van Cleef Bros., Chicago, Ill.

E

Eagle—Lead sleeving, bar and self-fluxing solder. The Eagle-Picher Sales Co., Cincinnati, O.

Eccentric—Solderless wire connectors. The High Tension Co., Inc., Phillipsburg, N. J.

Economy—Cable clamps. Jas. R. Kearney Corp., St. Louis, Mo.

Edison—Dry cell, primary and storage batteries. Thos. A. Edison, Inc., Bloomfield, N. J.

Electrad—Potentiometers and resistors. Electrad, Inc., New York City.

Electroline — Guy anchors, solderless, wire connectors Electroline Co., Chicago, Ill.

Electrunite—Steel conduit and steel tubing. Steel and Tubes, Inc., Cleveland, O.

Electro Meter—Solder pots, wax heaters. Electro Engineering Co., Inc., Richmond Hill, N. Y.

Electrox—Battery charging equipment, rectifiers. The Schauer Machine Co., Cincinnati, O.

Elliott—Addressing machines. The Elliott Addressing Machine Co., Cambridge, Mass.

Empire—Filing cabinets. Yawman & Erbe Mfg. Co., Rochester, N. Y.

ESICO—Electric soldering irons and pots. Electric Soldering Iron Co., Inc., New York City.

Eureka—Switchboard cleaners. Eureka Vacuum Cleaner Co., Detroit, Mich.

Eureka—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Eveready—Air cell telephone operators' transmitter batteries, flashlights. National Carbon Co., New York City.

Eveready Long Life—Dry cell batteries. National Carbon Co., New York City.

Exide—Storage batteries, battery connectors, storage battery racks, lighting emergency battery systems. The Electric Storage Battery Co., Philadelphia, Pa.

E-Z—Screw anchors. A. B. Chance Co., Centralia, Mo.

F

Fansteel—Electrical contact points. Fansteel Metallurgical Corp., North Chicago, Ill.

Fansteel Balkite — Battery chargers, rectifiers, condensers. Fansteel Metallurgical Corp., North Chicago, Ill.

Fibrex—Tree wire. Simplex Wire and Cable Co., Boston, Mass.

Fire-Stop—Rubber covered cable. National Electric Products Corp., Pittsburgh, Pa.

Fit-Rite — Knobs, cleats. Jas. R. Kearney Corp., St. Louis Mo.

● Advertisement in this issue—See Index to Advertisers, Page 106

Flexsteel—Cable connectors. National Electric Products Corp., Pittsburgh, Pa.

4-in-1—Guy and screw anchors. Jas. R. Kearney Corp., St. Louis, Mo.

Frankel—Testing clips and clamps, battery clips, solderless wire connectors. Frankel Connector Co., Inc., New York City.

French—Granular carbon. Le Carbone Co., Inc., Boonton, N. J.

Full of Power—Dry cell batteries. Siemens Bros. and Co., Ltd., Woolwich, London, England.

Full-Vu—Guy guards. Jas. R. Kearney Corp., St. Louis, Mo.

G

Garford—Motor trucks, tractors, trailers. Consolidated Motors Corp., Lima, O.

Gar Wood—Pole derricks and winches. Gar Wood Industries., Detroit, Mich.

GE—Cable and pothead compounds, soldering flux, self-fluxing solder, friction and insulating tape. General Electric Co., Bridgeport, Conn.

GEC—Telephones, switchboards, supplies. The General Electric Co., Ltd., Coventry, England.

Gibbs—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Goodrich—Friction tape. The B. F. Goodrich Co., Akron, O.

Gordon—Primary batteries. The Waterbury Battery Co., Waterbury, Conn.

Gould — Storage batteries, battery charging equipment, battery connectors, battery racks, rectifiers. Gould Storage Battery Corp, Depew, N. Y.

Gould—Guy anchors. Hubbard & Co., Pittsburgh, Pa.

Gray—Pay station telephones. Gray Telephone Pay Station Co., Hartford, Conn.

Ground-Ohmer—Ground resistance test sets. Herman H. Sticht & Co., New York City.

Groundometer—Ground testing meters. Electric Service Supplies Co., Philadelphia, Pa.

Guardene—Wet chemical fire extinguishers. Pyrene Mfg. Co., Newark, N. J.

Guardian—Burglar alarm systems. Guardian Electric Mfg. Co., Chicago, Ill.

H

Halseth—Pole stubbing clamps. The National Telephone Supply Co., Cleveland, O.

Handee—Buffing, grinding and polishing wheels. Chicago Wheel & Mfg. Co., Chicago, Ill.

Handitorches—Alcohol torches. The Turner Brass Works, Sycamore, Ill.

Handyman—Pole jacks, pole pushers. Harrah Mfg. Co., Bloomfield, Ind.

Hart & Hutchinson—Lockers. Tuttle & Bailey, Inc., New Britain, Con.

Hazard—Wire rope and cable. American Chain Co., Inc., Bridgeport, Conn.

Heller—Ladders. J. D. Warren Mfg. Co., Montpelier, O.

Hercules—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Hexacon—Soldering irons. Hexacon Electric Appliance Corp., Roselle Park, N. J.

Hexagon—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Hickory Screw End—Conduit tools. Cleverly Electrical Works, Inc., Philadelphia, Pa.

Hi-Line—Bolt clippers. Jas. R. Kearney Corp., St. Louis, Mo.

Hi-Value—Friction and insulatory tape. Johns-Manville, New York City.

Hitemeter—Pole height estimaters. Jas. R. Kearney Corp., St. Louis, Mo.

HKP—Bolt clippers, wire cutters, tree trimming equipment. H. K. Porter, Inc., Everett, Mass.

Hold Heat—Soldering coppers. The Turner Brass Works, Sycamore, Ill.

Hope—Wire sleeves, insulating tape. Hope Webbing Co., Inc,, Pawtucket, R. I.

Hotblast—Gasoline torches. The Turner Brass Works, Sycamore, Ill.

H. T.—Splicing clamps, solderless wire connectors, sleeve cords, wire splicing sleeves. The High Tension Co., Inc., Phillipsburg, N. J.

Hubbard—Pole line hardware. Hubbard Co., Pittsburgh, Pa.

Hughes—Cross-arms. Hughes Bros., Seward, Neb.

Hydrogarde—Fire extinguishing equipment. Pyrene Mfg. Co., Newark, N. J.

Hypowa—Bolt clippers, wire cutters. H. K. Porter, Inc., Everett, Mass.

I

Ideal—Motor generators. The Ideal Electric & Mfg. Co., Mansfield, O.

Ideal—Electric drills and grinders. The Schauer Machine Co., Cincinnati, O.

Ing-Rich—Advertising and warning signs. Ingram Richardson Mfg. Co., Beaver Falls, Pa.

Invincible—Switchboard cleaning systems. Invincible Cleaner Mfg. Co., Dover, O.

Invincible—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Ironite—Insulated drop iron wire. Kellogg Switchboard & Supply Co., Chicago, Ill.

Iwan—Earth augers. Iwan Bros., South Bend, Ind.

J

Jaydaline—Soldering flux. British Insulated Cables, Ltd., Prescott, Lancashire, England.

Jewell—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Jim Brown—Augers, concrete mixers, fire pots and furnaces, hoists, pliers, wire cutters (hand), tackle blocks, wire. The Brown Fence & Wire Co., Cleveland, O.

Jomanco—Friction and Insulating tape. Johns-Manville, New York City.

Joyce—Hoists, cable reel and pole jacks. The Joyce-Cridland Co., New York City.

K

Kardex—Visible records and index systems. Remington Rand, Inc., Buffalo, N. Y.

Kellems—Wire and cable grips. Kellems Products, Inc., New York City.

Kelly—Linemen's axes and hatchets, hammers, linemen's weed cutting equipment. American Fork & Hoe Co., Cleveland, O.

Kellogg—Telephone switchboards, instruments, equipment and supplies, complete. Kellogg Switchboard & Supply Co., Chicago, Ill.

Kester—Soldering flux, bar and self-fluxing solder. Kester Solder Co., Chicago, Ill.

Keystone—Expansion bolts. Diamond Expansion Bolt Co., Inc., Garwood, N. J.

Keystone—Open galvanized steel wire. Keystone Steel & Wire Co., Peoria, Ill.

Kidde—Pure water fire extinguishers. Walter Kidde & Co., Inc., Bloomfield, N. J.

Kiddefoam—Fire extinguishers. Walter Kidde & Co., Inc., Bloomfield, N. J.

Klein — Splicing clamps, linemen's climbers, fire pots and furnaces, pliers and wire cutters, sleeve tools, tackle blocks, tool bags, gasoline blow torches, tree trimming equipment, linemen's wrenches, tackles, hand lines, linemen's and electrician's knives, electrician's scissors, tool kits, fish tape pullers. Mathias Klein & Sons, Chicago, Ill.

Kleinkord—Belts, safety straps. Mathias Klein & Sons., Chicago, Ill.

Kling Klamps—Ground clamps. Reliable Electric Co., Chicago, Ill.

Knight—Paging systems, public address and radio equipment. Allied Radio Corp., Chicago, Ill.

Korduct—Asbestos conduit. Johns-Manville. New York City.

L

Latox—Lead encased cable. Simplex Wire and Cable Co., Boston, Mass.

Leadclad—Wire rope and cable. Leadclad Wire Co., Moundsville, W. Va.

Lead Giant—Storage batteries. Beckman Mfg. Co., Lima, O.

LeCarbone—Magneto and generator brushes, granular carbon. Le Carbone Co., Inc., Boonton, N. J.

Leverite—Compounds. Mitchell - Rand Insulation Co., Inc., New York City.

Lifetime—Telephone and switchboard cords. Independent Cord Co., Framingham, Mass.

Lightning—Hand pole hole diggers. Iwan Bros., South Bend, Ind.

Linedex—Index systems. Remington Rand, Inc., Buffalo, N. Y.

Littelfuses — Glass fuses. Littelfuse Laboratories, Chicago, Ill.

Littleford—Melting pots, tool boxes. Littleford Bros., Cincinnati, O.

Little-Six—Dry cell batteries. Burgess Battery Co., Freeport, Ill.

● Advertisement in this issue—See Index to Advertisers, Page 106

L & N—Resistance coils, condensers, electrical measuring instruments, resistors. Leeds & Northup Co., Philadelphia, Pa.

Lock Type—Cable racks. Hubbard & Co., Pittsburgh, Pa.

Longshore—Time switches for lights on current. Cleveland Time Clock & Service Co., Cleveland, O.

Long Span—Western red cedar poles. Bell Lumber & Pole Co., Minneapolis, Minn.

Lorraine—Granular carbon. LeCarbone Co., Inc., Boonton, N. J.

Lux—Carbon dioxide fire extinguishers, fire extinguishing systems. Walter Kidde & Co., Inc., Bloomfield, N. J.

Lux-O-Matic—Fire extinguishing systems. Walter Kidde & Co., Inc., Bloomfield, N. J.

M

Mack—Motor trucks, tractors, trailers, truck bodies. Mack Trucks, Inc., New York City.

Malloy—Storage battery water purifying and softening equipment, water stills. Malloy Mfg. Co., Madison, Wis.

Mansbridge—Condensers. The Electric Specialty Co., Cresco, Ia.

Marathon—Dry cell batteries. Marathon Battery Co., Wausau, Wis.

Marchant—Calculating machines. Marchant Calculating Machine Co., Oakland, Calif.

Marlin—Cable Hangers. The National Telephone Supply Co., Cleveland, O.

Mascot—Slide rules. Tavella Sales Co., New York City.

Master — Aircompressors and filters; branding equipment; dies; ladles; solder pots; torches; paint spray guns. Burning Brands Co., Chicago, Ill.

Masterbilt—Switchboards. Kellogg Switchboard & Supply Co., Chicago, Ill.

Mastergrip—Guy anchors. Aiken Anchor Co., St. Louis Mo.

Masterline—Guy anchors. Aiken Anchor Co., St. Louis, Mo.

Masterphone — Telephone instruments. Kellogg Switchboard & Supply Co., Chicago, Ill.

Masterwrenches — Wrenches. Jas. R. Kearney Corp., St. Louis, Mo.

Matlock—Cable rollers. The Dicke Tool Co., Inc., Downers Grove, Ill.

Matthews — Earth augers, wire rope clips, guy wire guards, pay-out and take-up reels. W. N. Matthews Corp., St. Louis, Mo.

Mead Morrison—Pole derricks and winches. Gar Wood Industries, Detroit, Mich.

Medart—Steel lockers and shelving. Fred Medart Mfg. Co., St. Louis, Mo.

Megger—Insulation and ground testing instruments. Jas. G. Biddle Co., Philadelphia, Pa.

Megohmer—Insulation test sets. Herman H. Sticht & Co., New York City.

Mereduc — Creosoted wood conduit. Wm. C. Meredith Co., Atlanta, Ga.

Micarta — Molded bakelite. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Micromax—Instruments for registering temperatures of paraffin and solder. Leeds & Northup Co., Philadelphia, Pa.

Milbradt—Rolling ladders. The John Calander Co., St. Paul, Minn.

Milonite—Insulated nails. Morley Button Mfg. Co., Portsmouth, N. H.

Minerallac—Cable clamps, cables, pothead and pulling compounds, cable and conduit hangers. Minerallac Electric Co., Chicago, Ill.

Minute Man—Fire extinguishers Pyrene Mfg. Co., Newark, N. J.

Monolithic—Cement conduit, Metropolitan Device Co., Brooklyn, N. Y.

Monophone—Telephone instruments. Automatic Electric Co., Chicago, Ill.

Monotype—Telephone and switchboard cords, telephone instruments, flameproof jumper wire. Automatic Electric Co., Chicago, Ill.

Monroe — Adding machines. Monroe Calculating Machine Co., Inc., Orange, N. J.

Murray—Cable racks, ladders for truck mounting, ground rods, tree trimming equipment and underground equipment. Metropolitan Device Corp., Brooklyn, N. Y.

Muter — Wheatstone bridges, knife switches. The Muter Co., Chicago, Ill.

N

Natco—Clay conduit. National Fireproofing Corp., Pittsburgh, Pa.

National—Toggle bolts, porcelain brackets, cable, cords, porcelain insulators, pole line hardware, wire. National Electric Products Corp., Pittsburgh, Pa.

National—Zinc cable clips; galvanized and copperweld aerial cable rings; galvanized bridle rings; double tube copper, tinned copper and tinned steel wire sleeves. The National Telephone Supply Co., Cleveland, O.

Neophone—Telephone instruments. Siemens Bros. & Co., Ltd., Woolwich, London, England.

Never-Creep—Anchors, anchor rods. A. B. Chance Co., Centralia, Mo.

New Easy—Bolt clippers, wire cutters. H. K. Porter, Inc., Everett, Mass.

New York—Ground clamps. The National Telephone Supply Co., Cleveland, O.

Nicopress—Copper and tinned steel wire sleeves, and sleeve tools. The National Telephone Supply Co., Cleveland, O.

Noise Killer — Condensers. Fansteel Metallurgical Corp., North Chicago, Ill.

Nokorode—Soldering flux, self-fluxing solder. The M. W. Dunton Co., Providence, R. I.

Non-Breakable — Messenger hangers. The National Telephone Supply Co., Cleveland, O.

Non-Positional — Telephone transmitters, Kellogg Switchboard & Supply Co., Chicago, Ill.

Noris — Carbon granulars, electrodes, globules and diaphragms. Noris Carbon Co., Inc., New York City.

North—Paging systems, dials, extension relays, resistors, ringing machines, signal systems, switchboards. The North Electric Mfg. Co., Galion, O.

Northern—Electric soldering irons and pots. Northern Electric Co., Chicago, Ill.

No-Tangle—Aerial cable rings. A. B. Chance Co., Centralia, Mo.

Nutype — Solderless wire connectors. W. N. Matthews Corp., St. Louis, Mo.

O

O. K.—Bolt clippers, wire cutters. H. K. Porter, Inc., Everett, Mass.

Oliver—Pole line hardware. Oliver Iron & Steel Corp., Pittsburgh, Pa.

Oshkosh—Crow, digging and tamping bars; canthooks, concrete mixers, digging tools, ladders, manhole guards, hand pole hole diggers, pay-out and take-up reels, warning signs, pike poles, pole supports. Leach Co., Oshkosh, Wis.

Oxweld — Oxy-acetylene and welding torches. The Linde Air Products Co., New York City.

Ozark—Anchors. A. B. Chance Co., Centralia, Mo.

P

Page—Guy and messenger strand, open galvanized steel wire. American Chain Co., Inc., Bridgeport, Conn.

Partridge—Northern white and western cedar poles. T. M. Partridge Lumber Co., Minneapolis, Minn.

Paruba—Mitchell-Rand Insulation Co., Inc., New York City.

Pease—Blue print equipment. The C. F. Pease Co., Chicago, Ill.

Peerless—Soldering flux. L. S. Brach Mfg. Corp., Newark, N. J.

Peerless—Electrical measuring instruments. The Thompson Co., Philadelphia, Pa.

Peirce—Expansion and toggle bolts, hand drills, pins and brackets. Hubbard & Co., Pittsburgh, Pa.

Perfection—Linemen's gloves. Mathias-Hart Co., Ampere, N. J.

Phillips—Wire (all kinds). Eugene F. Phillips Electrical Works, Ltd., Brockville, Ont., Can.

Phomaire—Fire extinguishers. Pyrene Mfg. Co., Newark, N. J.

Phomene—Foam type fire extinguishers. Pyrene Mfg. Co., Newark, N. J.

Phonometer—Time recorders. C. H. Graves Co., Philadelphia, Pa.

Plante—Storage batteries. Gould Battery Corp., Depew, N. Y.

Plastikon—Plastic and liquid rubber compounds. The B. F. Goodrich Co., Akron, O.

Poles With Character—Northern white and western cedar poles. Michigan Pole & Tie Co., Grand Rapids, Mich.

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Pole Saves—Signs, advertising and display, warning. Delta Mfg. Co., Chicago, Ill.

Powerite—Rectifiers. S. H. Couch Co., Inc., North Quincy, Mass.

P. P. Inc.—Porcelain insulators, porcelain knobs and cleats. Porcelain Products Inc., Parkersburg, W. Va.

Pratt—Enclosed fuses. Cleverly Electrical Works, Inc., Philadelphia, Pa.

Premax—Pole identification tags, ground rods. Premax Dw., Chisholm-Ryder Co., Niagara Falls.

Premier—Electric vacuum cleaners for switchboards. Electric Vacuum Cleaner Co., Cleveland, O.

Pre-Ser-Vor—Wood preservatives. Jas. R. Kearney Corp., St. Louis, Mo.

Prest-O-Lite — Brazing, oxy-acetylene, soldering and welding torches. The Linde Air Products Co., New York City.

Prest-O-Weld — Oxy-acetylene and welding torches. The Linde Air Products Co., New York City.

Purox — Oxy-acetylene and welding torches. The Linde Air Products Co., New York City.

Pyrene—Vaporizing liquid fire extinguisher. Pyrene Mfg. Co., Newark, N. J.

Pyrex—Glass insulators. Corning Glass Works, Corning, N. Y.

R

Rawlanchors—Concrete anchors. The Rawlplug Co., Inc., New York City.

Rawldrills—Masonry drills and concrete anchors. The Rawlplug Co., Inc., New York City.

Rawldrives—Concrete anchors. The Rawlplug Co., Inc., New York City.

Rawlplugs—Concrete anchors. The Rawlplug Co., Inc., New York City.

Ray-O-Vac—Dry cell batteries, flashlights. Ray-O-Vac Co., Madison, Wis.

Raytheon—Radio equipment. Raytheon Production Corp., Newton, Mass.

Ready — Pay-out and take-up reels. Ready Mfg. Co., Toledo, O.

Rectox — Battery charging equipment. Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.

Redege—Cable boxes. National Electric Products Corp., Pittsburgh, Pa.

Red Devil—Auger bits. Crescent Tool Co., Jamestown, N. Y.

Remington Rand—Adding machines, office furniture and supplies, typewriters. Remington Rand Inc., Buffalo, N. Y.

Resinkor—Self-fluxing solder. British Insulated Cables, Ltd., Prescot, Lancashire, England.

Richaudio—Fire extinguishers. Walter Kidde & Co., Inc., Bloomfield, N. J.

Ruberoid—Insulating compositions; paints and insulating tape. The Ruberoid Co., New York City.

S

Safe-File—Filing cabinets. Remington Rand Inc., Buffalo, N. Y.

Safety—Platforms, balconies, pole seats. Hubbard Co., Pittsburgh, Pa.

Samson — Stubbing clamps. Samson Mfg. Co., Centerville, Ia.

Schoenmehl—Primary batteries. The Waterbury Battery Co., Waterbury, Conn.

Schramm—Air compressors and welders. Schramm, Inc., West Chester, Pa.

Scrulix—Guy anchors. W. N. Matthews Corp., St. Louis, Mo.

Sealtite Static-Proof—Pole line hardware. Lewis Bolt & Nut Co., Minneapolis, Minn.

Seelye—Pole height estimators. Jas. R. Kearney Corp., St. Louis, Mo.

Select-O-Phone — Intercommunicatory telephones. Screw Machine Products Corp., The, Providence, R. I.

Selfvulc—Rubber compounds. Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.

Semper Idem—Resistors. Noris Carbon Co., Inc., New York City.

Senco—Lightning arresters, test sets, protective equipment. Sundt Engineering Co., Chicago, Ill.

S. & H.—Galvanometers and wheatstone bridges. Herman H. Sticht & Co., New York City.

Sherarduct—Steel conduit, steel tubing for conduit. National Electric Products Corp., Pittsburgh, Pa.

Shield Brand—Solder flux. Mitchell-Rand Insulation Co., Inc., New York City.

Sherman—Battery and fuse clips and solderless wire connectors. H. B. Sherman Mfg. Co., Battle Creek, Mich.

Sigalet-1 — Western red cedar poles. Sigalet & Co., Ltd., Lumby, B. C., Canada.

Signaphone—Burglar and fire alarm systems, signal systems. Signaphone Corp. of America, New York City.

Silvertown—Automobile and truck tires. The B. F. Goodrich Co., Akron, O.

Simplex—Cable reel and pole pulling jacks. Templeton, Kenley & Co., Ltd., Chicago, Ill.

Sitwell—Operators' chairs. Remington Rand, Inc., Buffalo, N. Y.

Skeleton — Telephone spoons and shovels. American Fork and Hoe Co., Cleveland, O.

Solderall — Self-fluxing solder. L. S. Brach Mfg. Corp, Newark, N. J.

Speed Wagon—Trucks. Reo Motor Co., Lansing, Mich.

Speer—Lightning arresters, brushes for magnetos and generators. Speer Carbon Co., St. Marys, Pa.

S.P.F. — Carbolineum wood preservatives. S. P. F. Wood-Preserving Co., Inc., Cambridge, Mass.

Squirrel — Linemen's climbers. The Dicke Tool Co., Inc., Downers Grove, Ill.

Standard—Earth augers. The Specialty Device Co., Cincinnati, O.

Star-Hamrtwist—Hand drills. Star Expansion Bolt Co., New York City.

Stazrite—Guy wire guards. Utilities Service Co., Inc., Allentown, Pa.

Steeltubes—Steel conduit and steel tubing. Steel & Tubes, Inc., Cleveland, O.

Steelwing—Screw anchors. Hubbard & Co., Pittsburgh, Pa.

Stephens—Linemen's climbers. W. H. Buckingham, Binghamton, N. Y.

Storm King—Dry cell batteries. General Dry Batteries, Inc., Cleveland, O.

StrucSteel — Storage battery racks. Gould Storage Battery Corp., Depew, N. Y.

Sturdee—Crow, Digging and tamping bars; canthooks; digging tools and pike poles. Joslyn Mfg. & Supply Co., Chicago, Ill.

Sturgis — Operators' chairs. Sturgis Posture Chair Co., Sturgis, Mich.

Sub-Cycle—Ringing machines. Lorain Products Corp., Lorain, O.

Super—Insulated drop bronze wire. Kellogg Switchboard & Supply Co., Chicago, Ill.

Supershyne — Plug polishing cloths. Ideal Products Co., Grand Rapids, Mich.

S-V—Dry cell batteries. Marathon Battery Co., Wausau, Wis.

Synchroverter—Converters and ringing machines. Electric Speciality Mfg. Co., Cedar Rapids, Ia.

Synthane—Laminated bakelite insulating composition, dials, insulation, panels, guy rods. Synthane Corp., Oaks, Pa.

T

Tablephone—Magneto telephones. Suttle Equipment Co., Lawrence, Ill.

Tasco—Slide rules. Travella Sales Co., New York City.

Tattelites—Miniature lamps. Littlefuse Laboratories, Chicago, Ill.

Techni-Tape — White adhesive tape. Van Cleef Bros., Chicago, Ill.

Telecell—Primary batteries. The Waterbury Battery Co., Waterbury, Conn.

Telechronometer — Telephone service meters. Garrison Babcock, Seattle, Wash.

Telefault—Cable testers. W. N. Matthews Corp., St. Louis Mo.

Teleheight—Pole height estimators. W. N. Matthews Corp., St. Louis, Mo.

Tele-Pak—Dry cell batteries. Tele-Pak Co., St. Paul, Minn.

Telering — Ringing machines. Telkor, Inc., Elyria, O.

Teletype — Teletypewriters, printing telegraph equipment. Teletype Corp., Chicago, Ill.

Telohm—Test sets. Electric Specialty Mfg. Co., Cedar Rapids, Ia.

Temperometer—Instruments to register temperatures of compound, parafin, solder and wax. Dillon Mfg. Co., Chicago, Ill.

Tenax—Expansion bolts. Diamond Expansion Bolt Co., Inc., Garwood, N. J.

The Blueprinter—Blueprinting equipment. Milligan & Wright Co., Cleveland, O.

Thermo—Lightning arresters. A. F. Hoppe Engineering Co., Indianapolis, Ind.

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Tirex — Telephone and switchboard cords. Simplex Wire and Cable Co., Boston, Mass.

Toledo—Manhole guards, warning signs and signals. The Toledo Pressed Steel Co., Toledo, O.

Tornado—Cleaners for switchboards. Breuer Electric Mfg. Co., Chicago, Ill.

Trackson—Cranes, pole erectors, power pole hole diggers, tractors. Trackson Co., Milwaukee, Wis.

Trailmobile—Trailers. McCabe-Powers Auto Body Co., St. Louis, Mo.

Transite—Asbestos conduit. Johns-Manville, New York City.

Trent—Solder pots, melting pots, wax heaters. Harold E. Trent Co., Philadelphia, Pa.

Tri-Six—Dry cell batteries. Burgess Battery Co., Freeport, Ill.

Tungar—Battery charging equipment, rectifiers. General Electric Co., Bridgeport, Conn.

Twin-Six—Dry cell batteries. Burgess Battery Co., Freeport, Ill.

Two-in-One—Insulating tape. The B. F. Goodrich Co., Akron, O.

U

Underwood — Typewriters. Underwood Elliott Fisher Co., New York City.

Underwood Sundstrand—Adding machines. Underwood Elliott Fisher Co., New York City.

Unelect—Induction coils, insulated drop bronze wire. Union Electric Co., Indianapolis, Ind.

Uniblade—Standard pressure and volume blowers. Autovent Fan & Blower Co., Chicago, Ill.

Unicool—Air conditioning equipment. Betz Unit Air Cooler Co., Kansas City, Mo.

Unique—Fire pots, furnaces, ladles, melting and solder pots, torches, wiping cloths. Unique Mfg. Co., Chicago, Ill.

Universal—Porcelain brackets, porcelain insulators. Universal Specialty Co., Terre Haute, Ind.

Universal—Testing clips and clamps, battery connectors, battery clips. Mueller Electric Co., Cleveland, O.

Univise—Solderless wire connectors. W. N. Matthews Corp., St. Louis, Mo.

USL—Storage batteries. USL Battery Corp., Niagara Falls, N. Y.

Ustent—Cable splicers' tents. U. S. Tent & Awning Co., Chicago, Ill.

Utility—Trailers. Utility Trailer Mfg. Co., Los Angeles, Calif.

V

Vac-M—Lightning arresters. The National Electric Specialty Co., Toledo, O.

Vacuum Grip — Bolt clippers, pliers, wire cutters, screwdrivers. Forged Steel Products Co., Newport, Pa.

Variohm—Resistors. Electrad, Inc., New York City.

Vaughn Patterson—Earth augers. Iwan Bros., South Bend, Ind.

V & B—Earth augers. The Dicke Tool Co., Inc., Downers Grove, Ill.

Veeder-Root—Hand, switchboard and typewriter counters. Veeder-Root, Inc., Hartford, Conn.

Vitrohm—Resistors. Ward Leonard Electric Co., Mt Vernon, N. Y.

Vulcan—Melting pots, soldering pots, soldering irons. Vulcan Electric Co., Lynn, Mass.

W

Warren — Screws, bolts, stock room parts, drills, cabinets. J. D. Warren Mfg. Co., Montpelier, O.

WB—Wire. The Whitney Blake Co., Hamden, Conn.

Waterbury—Primary batteries. The Waterbury Battery Co., Waterbury, Conn.

Wej-Lock — Anchors. A. B. Chance Co., Centralia, Mo.

West—Electrical test sets. Automatic Electric Co., Chicago, Ill.

Wheelock—Paging systems, horns and signals, extension relays, signal systems, interior fire alarm systems, bells. Signal Engineering & Mfg. Co., New York City.

Willard—Storage Batteries. Willard Storage Battery Co., Cleveland, O.

Wilhelm—Time switches for lights on current. Cleveland Time Clock & Service Co., Cleveland, O.

Wilkinson — Telephone pay station booths. Allen A. Wilkinson Lumber Co., Indianapolis, Ind.

Willard — Storage batteries. Willard Storage Battery Co., Cleveland, O.

Wireless—Cable testers. Electric Specialty Mfg. Co., Cedar Rapids, Ia.

W. L.—Rectifiers and battery charging equipment. Ward Leonard Electric Co., Mt. Vernon, N. Y.

Wodack—Electric drills, buffers and grinders. Wodack Electric Tool Corp., Chicago, Ill.

Wodack Do-All—Combination electric drills and hammers. Wodack Electric Tool Corp., Chicago, Ill.

Wolf — Oxygen deficiency indicators, flame safety lamps. Wolf Safety Lamp Co. of America, Inc., Brooklyn, N. Y.

Wood Hydraulic—Hoists. Gar Wood Industries, Detroit, Mich.

Wright—Air compressors, cranes and hoists. American Chain Co., Inc., Bridgeport, Conn.

Wrigraph—Drafting supplies. L. G. Wright, Inc., Cleveland, O.

Wyckoff — Creosoted wood conduit, crossarms, deadmen. Wyckoff Pipe & Creosoting Co., Inc., New York City.

X

XELA — Linemen's and electricians' knives and scissors. Mathias Klein & Sons, Chicago, Ill.

Xpandix—Screw anchors. W. N. Matthews Corp., St. Louis, Mo.

Y

Yankee—Hand drills, screwdrivers, tapping equipment. North Bros. Mfg. Co., Pittsburgh, Pa.

Z

Zeva — Electric solder pots, soldering irons. Van Praag Sales Corp., New York City.

Zonit—Fire extinguishers. Walter Kidde & Co., Inc., Bloomfield, N. J.

ZMA — Wood preservatives. Curtin-Howe Corp., New York City.

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figure 63. One section of cable was approximately 40 miles away from the test point, the other at the distant terminal. It is practically impossible to design a network which will match a line with such irregularities and the only recourse is to install loading coils so as to eliminate them.

● In addition to providing balancing equipment for the line we must also insert equivalent balancing networks for office equipment located adjacent to the repeater. This includes repeating coils, composite ringers, carrier filters, telegraph composite sets, etc. The most accurate way to balance complicated equipment such as a telegraph composite set is to insert the same equipment in the network as in the line. However, this often results in cumbersome and elaborate apparatus and generally can be avoided by the use of simplified circuits. For example, the standard telegraph composite set can be matched quite accurately with a 1 mf condenser in series with the line network. A repeating coil can be matched by means of a small inductance generally about 15 millihenries. This varies somewhat depending on the type of repeating coil. A practical method of determining the best network for a given condition consists of making an impedance run at the repeater terminals thus going through all the office equipment and thence out onto the line. An inspection of the resultant impedance curve will generally enable you to design a comparatively simple and accurate network without the necessity for matching each individual piece of office equipment. The design of networks in the final analysis is more or less a cut and try proposition. If we had only ideal lines we could use more or less standard networks. However, in most cases the line characteristics are not ideal and we must compromise to obtain the best possible balance.

● In many cases especially where there is considerable power induction or noise present on the telephone line we can use repeaters at the ends of the telephone circuit to considerable advantage by amplifying the outbound voice energy and inserting a loss on the inbound. The voice signals over-ride the noise and in effect reduces the noise on the circuit at the same time increasing the voice signal level. For example, if at each terminal we operate the repeater with a 20 db gain outbound and a 10 db loss inbound we obtain an effective overall gain of 10 db and at the same time reduce the noise level by 10 db. This scheme is very effective and has often proved an economical method of reducing the noise on a telephone circuit at the same time obtaining an improvement in voice transmission.

The use of terminal repeaters brings up a problem which is not present when a single repeater is in the center of two long sections of open wire line. This is the condition when there is no telephone connection established. Under such circumstances, one side of the repeater stands open and there is a badly unbalanced condition. Unless the gains are comparatively low the repeater will sing which may cause noise on adjacent circuits. One way to avoid this, at least in part, is to insert a pad generally about 4 db (see Table 10 Chapter VII) between the repeater and the telephone switchboard. This permits a partial balance when there is no telephone connection established and often is sufficient to keep the repeater from singing. Another scheme is to insert a balancing resistor generally about 600 ohms in the make contacts of the line jack of the telephone switchboard. This resistor will be automatically lifted when a line plug is inserted in the jack and a normal telephone connection established. If such a resistor causes any ringing difficulty, a 2 mf condenser may be inserted in series with it. Adequate balance may often be had merely by connecting a 1,000 ohm resistor across the line terminals of the repeater on the switchboard side. This in effect is similar to the use of the 4 db pad and I have found it to be just about as effective.

Still another method of preventing the circuit from singing when idle is to install an auxiliary contact on the line jack in the switchboard which either directly or by means of a relay, will open the plate circuit of the repeater vacuum tubes. When a connection is established by inserting a plug in the line jack the plate current will be automatically applied to the tubes.

The foregoing discussion is rather sketchy and obviously much more could be said regarding the operation of repeaters and the design of balancing networks. However, I hope that you will be able to obtain from this discussion a general idea as to the principles of operation which will permit intelligent maintenance and testing of the equipment. I have listed in the bibliography at the end of this chapter some books and articles which cover the subject in somewhat more detail and will provide interesting reading for those of you who wish to study the matter further.

(Please turn to page 109)

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MINNEAPOLIS, MINN.

LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. When is it necessary to make use of a 48-volt potential in a 24-volt manual exchange?

A. Sometimes a 48-volt potential is used on the toll position of a 24-volt exchange to improve transmission on long distance calls.

Q. What is the weight and resistance of a mile of No. 12 copper wire?

A. The weight of a mile of No. 12, hard-drawn, B&S bare copper is 104.5 lbs. The resistance per mile of a single conductor of this wire is 8.370 ohms.

Q. What type of cable terminal is considered best for outside cable construction?

A. All present-day terminals sold by reputable companies are satisfactory, in every way. These terminals while somewhat similar in general design may have certain features peculiar to a certain use. However, we are sure that they will all prove entirely satisfactory.

Q. What is the most satisfactory method of removing drop wire fixtures from stucco walls without causing damage to the stucco?

A. This is almost an impossible task and usually the attachments should be removed and then the walls repaired. Actually there is no need of removing fixtures from stucco walls unless requested to do so by the owner of the building.

Q. What type of safety signal is considered adequate warning for street openings on underground cable work?

A. One type which has proved desirable is an automatic opening stand on which the three legs spread automatically when picked up by the flag holder. This particular signal carries two flags and detachable sign plates. The signal stand will not blow over in an ordinary wind.

Q. What type of paint should be used on extension ladders?

A. In our opinion ladders should never be painted. Good ladders may now be obtained, at a reasonable cost, with the wood properly treated that it will not be affected by moisture. Ordinary paint adds considerably to the weight of ladders and makes them more rigid. It is believed this tends to cause them to snap and break more easily than when the wood is unpainted.

Q. Please advise the most economic method which may be used to supply current for the operators set when alternating current is available?

A. A small storage battery of proper voltage with a good trickle charger makes a most satisfactory arrangement. A small copper-Oxide rectifier unit is available which may be used without a storage battery, if a suitable dry-cell battery is available which may be cut into the circuit in case of power failure.

Q. What is considered a standard crossarm for toll lines and how are the pins spaced?

A. The crossarm usually considered standard for toll lines are ten pin and measure ten feet over all. The pole pins are spaced on 16 inch centers and the other pins on 12 inch centers. The outside pins are four inches in from the end of the arm. The same pin spacing is sometimes used on six pin crossarms.

Q. Will a modern common battery switchboard operate with greater satisfaction when using twelve instead of eleven cells of storage battery?

A. If the switchboard is designed for 24-volt operation, as most modern switchboards are, the eleven cells will be satisfactory. The twelve cells may cause excess current to flow through some parts of the apparatus. Even though the extra cell may not cause any trouble it will not produce any noticeable benefit in most cases.

Q. What is considered the principal electrical hazard to outside telephone plant?

A. The ones which ordinarly receive special attention from protection standpoint are: lightning, which has an extremely high voltage; extra-high potential current, above 5,000 volts; high-potential currents, from 601 to 5,000 volts; low-potential currents, of 600 volts or less. Telephone lines which may come into contact with lines of potential in excess of 250 volts are generally considered exposed and requiring protection.

Q. What capacity is permissable on a subscribers line in a modern automatic exchange?

A. This will depend considerably on the type of equipment being used and the following is given as an indication only. When telephones are equipped with standard 1400-ohm, individual line ringers and 1-MF condensers, not more than five ringers should be connected across the line, nor more than five ringers connected between each side of the line and ground when loop dialing is used.

Q. What type of inexpensive line construction body is considered desirable for use in the small exchange and on rural line work?

A. A type of body now available is easily adapted to any commercial half-ton chassis with a pick-up body, and should answer your purpose admirably. This body is designed to carry all equipment and material in special compartments, overhead ladder racks for carrying section ladder, step ladder and tree trimmer, can be furnished when required. Space is available through the entire bed of the pick-up body for tools and material.

Q. Please advise the proper method of constructing a manhole guard?

A. Due to the fact that good manhole guards can be purchased so cheaply their local construction is not considered desirable. The modern guard is strong, light and folds up when not in use. They are also provided with a socket for holding a flag when not in use. These folding guards have the advantage that they may be chained and locked to a pole at night when not in use.

Q. Is it possible to obtain a cordless switchboard of over 12 lines and three trunks?

A. Cordless switchboards have been made special to accommodate as many as 50 lines. This type switchboard can now be obtained from stock to accommodate not over 20 subscribers lines, five trunk lines and five conversational channels which correspond to cord circuits on a regular manual switchboard.

Telephone Transmission Theory and Practice

(Continued from page 107)

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1—Electrical Communication by Arthur L. Albert. Order through TELEPHONE ENGINEER.

2—Transmission Circuits for Telephonic Communication by K. S. Johnson. Order through TELEPHONE ENGINEER.

3—Telephone Repeaters by B. Gharardi and F. B.. Jewett. Trans. A.I.E.E. Vol. 38. p 1286.

CORRECTION

● Chapter IX, Fig. 47—Direction of current arrow in line circuit should be reversed.

(TO BE CONTINUED)

Inductive Coordination

(Continued from page 40)

greater, for the distances of a point so situated from the individual power wires are closely the same. When the separation varies, as in slanting exposures, the effect due to current or voltage of the different phase wires varies, so the induction in different portions along a conductor so exposed varies in phase, and thus it is impossible to correct for the induction in a communication circuit exposed to it, by transpositions.

When, as in the residual current circuit, the earth forms one conductor, the current spreads through the large mass of the earth. In earth of low resistivity, such as salt water, or marsh lands, bodies of metallic ores, etc., most of the current flows near the surface, and the average current is not deep, sometimes only 200 to 400 feet down. In areas of high resistivity, such as granite mountains, etc., the average current may be several thousand feet below the surface. Every gradation exists between these extremes, and often very irregularly.

● When there is a large distance between the two sides of a loop carrying current, the field due to current in one of the conductors is widely dispersed, and the distances from the two do not become nearly equal until a very great separation from the circuit is reached. The electric field due to voltage of the conductor or conductors above ground does not extend very far from the line, as the wire or wires form one side of a condenser, the other being practically the surface of the earth.

In rural electrification most of the telephone circuits are of the grounded type, consisting of a single wire with ground return, as indicated in Fig. 3. Such a line exposed to a power circuit carrying residual currents may be practically inoperative, for the conditions conduce to the greatest induction between the two.

"Metallic" or two-wire telephone circuits, as shown in Fig. 4, experience less trouble from either balanced or residual components, as practically the same voltage is induced on each of the two wires. Some noise may result, however, from any lack of complete balance on the telephone circuit, leading to a flow of current from one wire to the other through the receiver.

It is possible to obtain some of the benefits of the metallic circuit on a ground-return circuit by metallicizing that part of the line which is exposed, as indicated in Fig. 5.

● Most telephone needs can be met by circuits which are not completely balanced. Splices, wire variations, bells, etc., all introduce resistance and capacity elements into a circuit, so only a reasonable balance is ordinarily justified.

Even on metallic lines, in a parallel, a "fault" or short circuit from power line to ground, resulting in a heavy residual current flow in the earth, will induce a high voltage above ground on the telephone wires, which may cause breakdown of the equipment, or "acoustic shock" to anyone listening in at the time.

From the foregoing discussion, the reasons for the following suggestions relative to construction of power and telephone circuits in rural areas can be appreciated.

1. Avoidance of parallels is advisable wherever practicable.
2. In parallels the telephone circuit should be metallic (two-wire) either completely, or at least in the portion exposed.
3. Power circuits and telephone circuits should be kept at a uniform separation so far as practicable; sections having different separations for considerable distances should be treated as separate parallels.
4. In parallels the power circuit should be transposed to neutralize the induction on the telephone circuit from balanced currents so far as practicable, and the telephone circuit should be transposed to equalize the induction on the two wires between transpositions on the power circuit.

*More complete definitions of these terms are given on page 9 of the book, **Inductive Coordination**, by the writer of this article. Order from TELEPHONE ENGINEER—$3.00.

THE END

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Resolution of Association

(Continued from page 36)

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W. C. Henry
F. R. McBerty
J. F. O'Connell
Louis Pitcher
Geo. A. Scoville
Geo. A. Yanochowski

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December Increase

General Telephone Corporation reports for its subsidiaries a gain of 1,301 company-owned telephones for the month of December, 1936, as compared with a gain of 955 telephones for the month of December, 1935. The gain from operations during 1936 totals 19,941 telephones, or 6.35%, as compared with a gain of 11,874 telephones, or 3.95% for 1935. During 1936 there was an additional increase of 2,457 telephones through purchase which are excluded from the net gain figures.

The subsidiaries now have in operation a total of 334,716 company-owned telephones.

CONVENTION SCHEDULE

Minnesota Telephone Association, Hotel Lowry, St. Paul, January 19, 20 and 21.

Nebraska Telephone Association, Hotel Lincoln, Lincoln, Neb., February 9 and 10, 1937.

Texas Telephone Association, Baker Hotel, Dallas, March 16, 17 and 18, 1936.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, March 23 and 24th.

Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, April 6, 7, and 8.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 11 and 12, 1937.

Ralph Van Trine To Telephone Bond & Share

Association of Ralph Van Trine, prominent telephone executive, has been announced by Telephone Bond & Share Company, Kansas City, Mo. With headquarters at the home office his duties will be with the operating subsidiaries rendering advice and assistance to the many operating companies of this group.

Having held executive positions with telephone operating companies for the past 23 years, Mr. Van Trine has thorough knowledge of all phases of the telephone business and is widely and favorably known throughout the industry. For several years he was vice-president and general manager of the United Telephone Company of Pennsylvania.

Mr. Van Trine is a graduate of Kansas State College. Immediately on graduation entered the telephone industry and has become one of its leading and most aggressive executives.

By C. K. BROWN

Switchboard Maintenance

PART VII

Principal methods of signalling, control of out put efficiency and other features regarding P.B.X. switchboard lamps is discussed in this, the eighth part of a series.

IN P. B. X. switchboard operating practices one of the principal methods of signaling, that is, attracting the attention of the switchboard attendant, is by means of miniature incandescent lamps.

The switchboard lamp comprises a filament of either carbon or a suitable metal usually of a shape approximating to a letter "U", and is inclosed in a small tubular shaped glass bulb within which a vacuum is produced.

The filament has a high melting point and a suitable high resistance, and is of sufficient hardness not to become plastic when heated.

The purpose of the vacuum is not only to prevent the oxidation of the lamp filament, but also to prevent the loss of heat, which would tend to reduce the operating efficiency of the lamp.

● Conducting wires passing through the sides of the glass bulb are connected to strips of metal so designed as to make contact with the lamp jack or socket, and from there to the source of electric current, which heats the filament causing it to emit light, that is, a heated body radiates energy in the form of waves into the surrounding space. The lower the temperature the longer will be these waves, but at the lower temperature heat only is given off. As the temperature increases, the heat waves become shorter and red rays begin to appear. With continued increase in the temperature, shorter and shorter waves are produced, giving rays of light of different colors until at certain temperatures white light which is a mixture of all colors is emitted.

The heating of the switchboard lamp filament is due to the resistance offered to the flow of an electric current through it. All of the lamp resistance not manifesting itself through heating the very thin filament represents lost power and waste.

The useful life of the switchboard lamp filament depends upon the temperature at which it is operated, and this temperature will be roughly proportional to the rate at which it is developed by the electric current. While the lamp filament is burning it's material is constantly evaporating, that is, being thrown off and deposited upon the inside walls of the glass bulb.

● The dark appearance of old switchboard lamps is a familiar manifestation of this action. As the amount of the filament material diminishes, the resistance of the filament of course increases with the result that if it is operated with a constant filament current the operating temperature goes up continually as the lamp becomes older.

A practical scheme to restrain the operation of the switchboard lamp at an increasing temperature is to use, rather than constant current, a constant E. M. F., in which case the temperature is roughly proportional to E^2/R, and as the lamp filament resistance goes up due to evaporation, the operating temperature decreases, and the life of the lamp is prolonged.

An increase of approximately 3% of the rated current value of the lamp halves the life of the lamp, and a decrease of 3% approximately doubles it. This will indicate the importance of proper attention to this detail of P. B. X. switchboard operation.

Another method of controlling the output efficiency of a P. B. X. switchboard lamp is by means of what is termed overrunning. By this is meant operating the lamp on an E. M. F. slightly higher than that for which it is intended. In this manner the lamp consumes slightly more than it's normal current which thus raises it's temperature above it's ordinary working value. More light is given out, the percentage of increase of this being greater than the percentage of increase in the power consumption. The lamp thus operates more economically, but the length of it's useful life is decreased.

● Instead of operating a lamp at an E. M. F. slightly higher than normal, it may be operated at an E. M. F. rather less than that for which it was originally intended. This reduces the temperature and candle power, but increases the active life of the lamp.

A P. B. X. switchboard lamp intended for use at one E. M. F. should not be used on a circuit of widely different E. M. F., that is, operate a 24 volt lamp on a 48 volt circuit. Since two lamps of the same candle power intended for use on two different E. M. F.'s will have widely different resistances. Although two lamps may have the same power consumption, the higher voltage lamp will operate on a smaller current value. This means that it's resistance is higher, and a filament will be longer or thinner and probably both. Take for example, the case of two 3 watt switchboard lamps, one intended for use at 24 volts direct current, and the other 48 volts direct current. Their current values are $3/24=0.125$ amperes and $3/48=0.067$ amperes respectively, and their respective resistances are 192 ohms and 731 ohms nearly.

● The switchboard incandescent lamp is the expression of a fundamental law of electric current supply, which is to the effect, that resistance in a circuit should be concentrated at the point where energy is to be developed, that is, in an electric circuit devoted to the operation of telephone machinery, the majority of the circuit resistance should be in the machines, and as little as possible should be in the conductors. Therefore, if the switchboard lamps are to be properly lighted, as much of the total resistance in the lamp circuit as possible should be concentrated in the lamp.

Washington

(Continued from page 32)

charges to the users of hand sets for the various states during the 10-year period of 1928 to 1936 varied greatly in different sections of the country. It was charged by the FCC investigators that the Bell System had only made one voluntary reduction of the hand set added charge when the original 50 cents per month charge levied in 1927 was cut in half. But telephone company officials cited this as one of a number of inaccurate conclusions advanced in the Investigation reports and related that voluntary decreases in the hand set charges had been made in more than 30 states by the Bell System companies.

In the attack on the Bell System policies regarding the hand set, the Investigation Chief Engineer Cyrus G. Hill and his assistant, C. L. Terrel, displayed an inconsistent line of criticism, it seemed to a number of observers at the hearing. Hill on the one hand censured the Bell System for its failure to introduce a hand set type invented in 1907 and waiting until 1927 when it was introduced into the telephone service. Terrel in his testimony tried to show that the hand set model introduced in 1927 had not been fully tested and was not ready for public use so that large maintenance and operating costs developed. The FCC engineer used correspondence from Col. T. F. Purves, British Post Office Engineer, about noise factors of the 1927 hand set instrument to prove the allegations about the defects.

● Another interesting subject, taken up by the Investigation during the December hearings, was a comparison between the prices of certain types of telephone equipment offered by the Western Electric Co. and by leading Independent manufacturing companies. The FCC engineering investigators, headed by Chief Engineer Hill, disclosed that Independent companies, such as Kellogg Switchboard and Supply Co., Automatic Electric Co., Stromberg-Carlson Co., etc., had been successful in bidding against Western Electric for telephone equipment of Independent companies in a number of instances. Mr. Hill, however, agreed that the price and exchanges applied only to telephone service and exchanges in small towns and communities and no analysis of the equipment costs of Western Electric and Independents had been made in connection with large city exchanges. The revealing of the purported examples of cheaper telephone equipment manufactured by the Independents than by Western Electric was evidently propounded with the objectives of the FCC trying to build up the idea that the Bell System should buy its equipment on the "open market. Rather than from Western Electric. In his testimony, however, Mr. Hill reiterated the theory, previously advanced in the FCC Investigation, that the Independents were under the domination of Western Electric. He cited the amount of manufacturing work allocated to the various Independent companies by the Bell System as an example of this alleged domination.

● The six days of hearings on the activities of Electrical Research Products Inc. (ERPI), held in New York during the Christmas and New Year weeks, were designed to show the attempt of ERPI to establish a monopoly in the sound motion picture equipment field and the danger to the telephone rate base through permitting the A. T. & T. to engage in activities outside the telephone business. Several former officials of ERPI, its present executive and A. T. & T. president Gifford were witnesses during the hearings as Investigation counsel Samuel Becker tried to bring out past activities of ERPI.

(Please turn to page 114)

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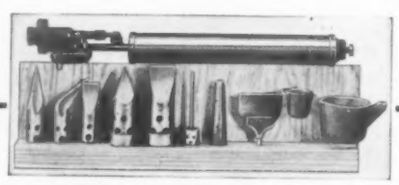
2120 East 19th St.
Cleveland, Ohio

At Remarkably Small Cost
AVENARIUS TRADE MARK CARBOLINEUM
PRESERVES WOOD EVERYWHERE
KEEP POLES from ROTTING
Write
CARBOLINEUM WOOD PRESERVING COMPANY
22 Carbolineum Bldg. Milwaukee, Wis.

Poles With Character
MICHIGAN POLE & TIE CO.
NORTHERN AND WESTERN POLES
Newberry, Mich. - Grand Rapids, Mich.

PUSH PIPE WITH A GIANT
Save 80% of Your Trenching Cost

Write for Catalog
Dept. 4-P
GIANT MFG. CO.
Council Bluffs Iowa



The entire answer to difficult soldering, blow torch and branding problems. Especially manufactured and adapted for outside work under unfavorable weather conditions. Soldering tips, flame reducer, paint scraper, swivel dipping cup, self skimming ladle and individual branding dies easily and quickly attached to burner head for instant use. Samples gladly sent on approval.

BURNING BRANDS CO.
1400 FULTON ST. CHICAGO, ILLINOIS
Dealer inquiries welcomed.

CORDS
Cables — Drop Wire — Batteries
Printing and Accessories
"Lifetime" cords—ex. heavy bronze tinsel.
Send for cord chart and free samples.
INDEPENDENT CORD CO.
FRAMINGHAM, MASS.

American Coach & Body Co. Now Located in New Plant

The American Coach and Body Company are now located in their new and enlarged plant at 9503 Woodland Avenue, Cleveland, Ohio. This company is the largest exclusive manufacturer of standard utilities equipment for motor vehicles.

In its new and modern factory located on the main lines of the Nickle Plate and New York Central railroads, the American Coach and Body Company has 200,000 square feet of floor space for manufacturing public utility equipment for motor vehicles. This includes line construction bodies with a seven man crew compartment, telephone installation and service, gas and electric meter, street light patrol bodies, pole trailers, winches, power take-offs, pole derricks, and associated equipment.

With this new plant, they are better equipped to meet the requirements of its steadily increasing list of customers.

The company's plant was formerly located at 3809 Clark Avenue, Cleveland.

CB-30 Charger

Fansteel Balkite

Taper-Charge Rectifier

Prevents Overcharging and Running Down of P.B.X., Toll and Small Exchange Batteries.

Overcomes battery troubles and shortened life, caused by overcharging and undercharging. Automatic self-regulation delivers a variable output that follows the traffic load over a wide range. The output automatically rises with increased switchboard load and drop in battery voltage, tapering to a lower rate as the battery charges during light or no traffic period. Self-contained. No complicated or external controls.

Send for Bulletin TC-45-S on this battery saving rectifier.

Type FT-10 Tantalum Noise Killer Condenser For Pole Changer Ringing Machines

When your present noise-killer is worn out, save yourself money and maintenance by replacing it with this inexpensive high-capacity Tantalum condenser. Simply remove old noise-killer and connect FT-10 condenser in its place. No upkeep. No maintenance.

Send for Bulletin TC-47-S

FT-10 Condenser

FANSTEEL METALLURGICAL CORPORATION

NORTH CHICAGO, ILLINOIS

Reliable

EQUIPMENT

FUSES

SLEEVES

ARRESTERS

CABLE GRIPS

MAIN FRAMES

GROUND CLAMPS

CABLE TERMINALS

DROP WIRE CLAMPS

ZINC CABLE HANGERS

BABY KNIFE SWITCHES

BRIDGING CONNECTORS

INDOOR CABLE TERMINALS

SUBSTATION PROTECTORS

SWITCHBOARD PROTECTORS

WRITE FOR SAMPLES

Reliable ELECTRIC COMPANY

OVER 25 YEARS SERVICE TO THE UTILITIES

3145 CARROLL AVENUE · CHICAGO ILLINOIS

Telephone Testing Apparatus

Shallcross precision instruments are important to the telephone man for accurate measurements in the telephone field.

Type 628
Fault Location Bridge

This instrument was designed for locating faults in cable, such as grounds, opens, crosses, or shorts and inductive crosses or split pairs, with simplicity of operation.

The Fault Location Bridge provides three types of measurements, Wheatstone Bridge, Murray and Varley Loop.

The above features make this new unit a very handy instrument in the telephone field.

Type 614
Telephone Service Meter

This instrument was developed by telephone men for the exchange man and trouble shooter. Covers all fundamental tests and will not become obsolete. It is flexible, rugged, and portable which makes this instrument useful for testing subscriber's sets, central office circuits and central office power equipment.

Write Department N for literature describing these instruments.

Shallcross Mfg. Co.
COLLINGDALE, PA.

Washington

(Continued from page 112)

Another subject, taken up by the Investigation engineering staff, charged that the overbuilding of the telephone plant of the American Telephone and Telegraph Co. Long Lines department prior to the depression years had resulted in including in the telephone plant investment large quantities of plant neither useful at present nor to be used within any economic future period. In his testimony, FCC Investigation Chief Engineer Hill charged that this overbuilding was due to imprudent construction resulting from erroneous forecasts of toll traffic needs and due to contraction of business during the depression. Another allegation, which Mr. Hill, who is a former Independent consulting engineer, asserted, was that improvements in the art have rendered obsolete certain types of the existing toll plant.

The FCC's main contention against this excess plant was that operating expenses, notably depreciation and maintenance, were recorded on the companies books and paid for the rate base by the public. The Investigation engineer charged that 25 per cent of the present Long Lines plant which totals $433,000,000 in book value consisted of excess plant which "would remain permanently idle". Mr. Hill indicated that similar conditions might be expected in the exchange field. He alleged that in the Long Lines plant only about one-half the wire plant is in use, while a survey of toll switchboard units showed approximately twice as many are installed as are in use. His study took in conditions of the depression and through 1935.

● Although the FCC Investigation staff in its "analysis" of the Long Lines plant avoided mention of the improvement of service and of the need for excess plant for peak loads of telephone users, officials of the A. T. & T. informed the press that the present plant was necessary to maintain an efficient long distance network and service and also pointed out that the present plant was a major reason for the great improvement and efficiency in toll connections, citing the decrease from 3.9 minutes per connection in 1929 to 1.5 minutes in 1935.

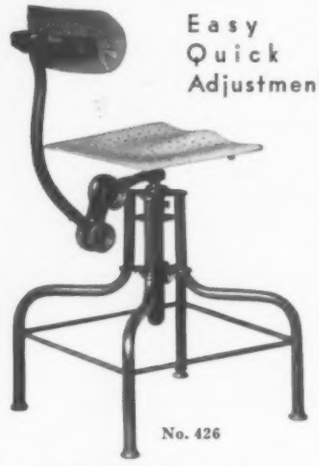
THE Telephone Industry may find it desirable to observe with greater interest and significance during this winter the shaping of labor and taxation programs by the second Administration of President Roosevelt and the new Congress. Meanwhile, the FCC is going to plow ahead with its Telephone Investigation hearings and the shaping

(Please turn to page 116)

STURGIS

TRUE POSTURE
Operator Chairs

Easy
Quick
Adjustments



No. 426

A true posture chair designed to increase efficiency, mental alertness, reduce fatigue, improve the health and comfort of the operator.

Write For Particulars
Available in 3 Different Heights.
Distributed by

STROMBERG-CARLSON TELEPHONE MFG. CO.
100 Carlson Road, Rochester, New York

Manufactured by
STURGIS POSTURE CHAIR CO.
Sturgis, Mich.

FOR QUICKER EASIER TRIMMING WORK
use
SEYMOUR SMITH
TELEPHONE PRUNERS
Important users say, "We have had excellent reports from our men in the field." "Is easier on the operator; performs the work faster than any other pruner head we have ever used." "We have not experienced any breakage whatsoever." "In constant use nine hours a day for the past three months—proves to be the best pruner head made." "All of our men are asking for this type and we will have to take the others off the field."
Reports like these and constantly growing orders from public utility companies prove the superiority of Seymour Smith Telephone Pruners. Why don't you write us for prices and complete information?
No. 11
Pruner
Head
Length
10"
Overall
Wt. 1¼ lbs.
SEYMOUR SMITH & SON, INC.
131 Main Street
OAKVILLE, CONNECTICUT

Who Pays The Bills?

(Continued from page 42)

phone companies for making grounded lines metallic, but, as we have pointed out, this does not meet the annual charges which will immediately accrue and continue so far as the telephone companies are concerned.

● If the electric companies are to reimburse the telephone companies for the continuing costs, it must be done by an annual payment of a sum sufficient to cover maintenance, depreciation, taxes, and any other item of operating expense, and these items should be paid by the power companies each year. Obviously such a suggestion is too cumbersome to be practical.

The only answer therefore, we repeat, is for the telephone company to make the necessary investment and adjust its rates so that it will be compensated for the annual charges.

● In our opinion, the foregoing is the proper answer from an economic standpoint. The telephone company is charged with providing its subscribers with the best grade of telephone service. It can only do this by taking into consideration all costs and receiving sufficient revenue to meet them.

Davey Line Clearing Service

You'll Like Davey Men

It's an old saying that any service is only as good as the men who deliver it. A lot of truth in it, though. Excuse us while we brag about our men. They are:

- Industrious
- Tactful
- Specially Trained
- Long Experienced

Davey men like to do a good job. They get a kick out of licking tough situations. They can give you a brand of line clearing service that will please you unusually well. Try them once.

THE DAVEY TREE EXPERT CO.

Kent, Ohio

DAVEY
TREE SURGEONS

Suttle's Newest Magneto Telephone

The *Crystopac*

The Crystopac incorporates the attractive features of the Suttle Tablephone in a new wall compact cabinet, including:

1. Modernistic designed cabinet.
2. Beautiful new crystallized finish available in six colors.
3. Enclosed gongs—Cloth Screen opening.
4. "Chassis Mounting" of parts—permitting removal of top case and easy access to wiring.
5. Handset feature which can be used standing or sitting.
6. The latest new Leich Handset providing highest standards of transmission.
7. Small size that is popular with subscribers.
8. Light weight—Less shipping cost—Easier to install.

It is a fine talking instrument — sturdily built, and fully guaranteed.

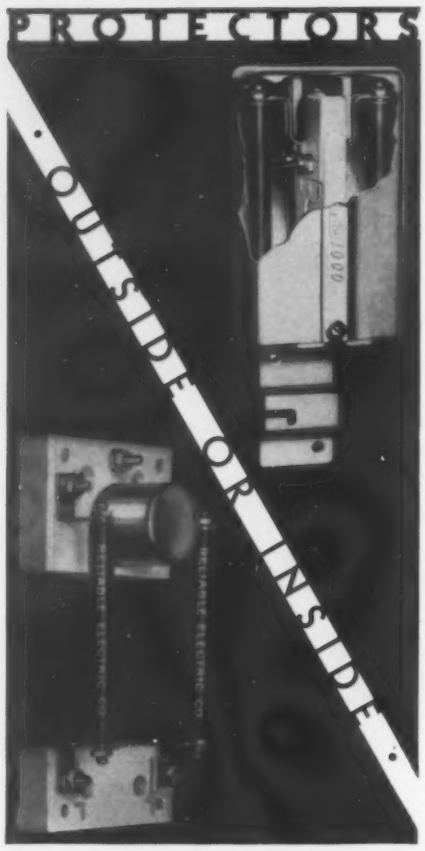
It is a splendid investment with which to make money on local battery stations.

ORDER SOME TODAY—PRICES AND FULL DETAILS IN SUTTLE SALESMAN CATALOG NO. 42

Manufactured and Sold Only By

Suttle Equipment Company

Lawrenceville, Illinois



Reliable

No. 1000

A sturdy weather proof protector made to accommodate many types of standard telephone fuses.

No. 977HH

The No. 977HH indoor substation protector is continuing to lead the field because of its outstanding design and efficient operation.

WRITE FOR SAMPLES

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

Washington

(Continued from page 114)

and strengthening of its regulatory functions and powers, but as it appears at this time, much of its work probably will be directed in 1937 towards consolidation of the foundation for future regulatory projects.

● Legislation, dealing specifically with the communications industry and the FCC, except possibly some measures in connection with the Commission's broadcasting activities, will record a virtual blank on the new congressional program, it is expected. The FCC, according to leaders of the Senate and the House, will only figure during the early part of the Congressional session during the consideration of the $350,000 additional appropriation for the continuation of the Telephone Investigation, bringing up the total expenditure for that inquiry to $1,500,000. It is, however, regarded as practically assured that Congress will approve the added $350,000 although the poor results of the Investigation during last spring's hearings may revive some criticism of the inquiry during the Congressional debate.

Labor legislation probably will transcend all other issues that will be brewing in the National Capital's cauldron during this winter and spring in importance and interest to the telephone industry as well as to other industries. First, the President owes only one major obligation for support at the polls—that is to labor, and it is well-known that he desires to secure satisfactory minimum wages and hours of labor for all industries such as was projected under the NRA. Second, many members of Congress are advocating some form of labor legislation, ranging from the 30-hour week plan of Senator Black of Alabama to the O'Mahoney bill for regulation of labor, wages and conditions through federal corporation licensing. As a third basis for the important role of labor legislation is the fight by John L. Lewis and his Committee on Industrial Organization (C. I. O.) being waged to unionize major industries.

● Lewis to usher in 1937 sounded a call for his C. I. O. movement which may have included an implied possible threat for the unionization of the telephone industry. The C. I. O. leader in a nation-wide radio broadcast censured the Bell System for its decline in employment figures between 1929 and 1933, while maintaining the $9 dividend payment. Because of the political aspect, Lewis especially criticized Walter S. Gifford, American Telephone and Tele-

Crapo
GALVANIZED PRODUCTS

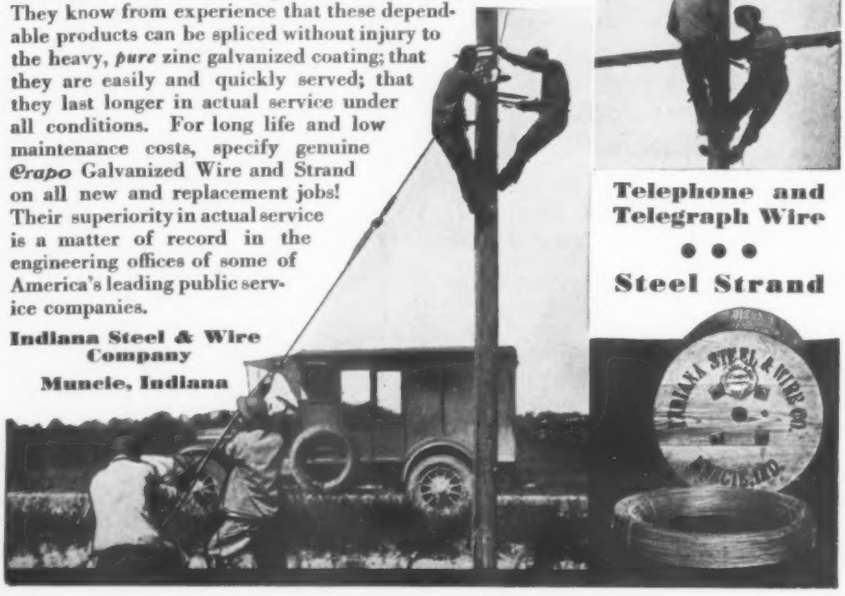
INDIANA STEEL & WIRE CO · Crapo Galvanizing · MUNCIE, IND.

Line Gangs Know from Actual Experience

MEN in the field recognize the outstanding advantages of *Crapo* Galvanized Telephone Wire and Steel Strand. They know from experience that these dependable products can be spliced without injury to the heavy, *pure* zinc galvanized coating; that they are easily and quickly served; that they last longer in actual service under all conditions. For long life and low maintenance costs, specify genuine *Crapo* Galvanized Wire and Strand on all new and replacement jobs! Their superiority in actual service is a matter of record in the engineering offices of some of America's leading public service companies.

Indiana Steel & Wire Company
Muncie, Indiana

Telephone and Telegraph Wire
● ● ●
Steel Strand



graph Co. president, for this employment policy, directing his attack on Mr. Gifford due to the latter's service under former President Hoover in charge of relief and unemployment aid work. Lewis used the employment decline figures which had been advanced by FCC Counsel Samuel Becker last March in the Telephone Investigation. Becker, it will be recalled, refused to accept the Bell System's exposition of the employment situation until last month for introduction into the record of the inquiry. The telephone company claimed that the Investigation charge of a 132,000 employees' drop was not accurate, citing that during the depression the 50,000 operator training school and other similar units had had to be abandoned which accounted for much of the decline.

● While Lewis may make a later drive for organization of telephone employees as is thought among some of his adherents in Washington, the C. I. O. leader first has to achieve victories in the auto and steel fields and such results may not be easily accomplished. President Roosevelt has given approval to arbitration methods, it is felt, by his proposal of that plan of handling labor problems by the railroads. Then to counter the C. I. O. auto strike movement, there has been definite opposition by some of the American Federation of Labor craft unions as well as by workers themselves forced out of jobs

(Please turn to page 119)

New Catalog Completed

Reliable Electric Company has just issued a new catalog covering its complete line of telephone protectors, cable termials and outside specialties. The catalog is made up of separate bulletins bound loosely so that it opens flat. New bulletins or supplements can be added easily. These bulletins are printed in very attractive form with similar equipment grouped together and shown in the same colors, making it easy to locate the items as well as pleasant to read.

New equipment in the process of development will be announced in 1937 and supplements will be issued for catalog insertion. Requests for additional copies will be filled promptly.

ENGINEER WANTED
By Telephone Manufacturer

Experienced and capable in manufacturing telephone apparatus for Magneto and common battery systems. Opportunities for the right man. Location — Far East. Reply giving full particulars—experiences, salary expected, etc. to **Box WCT, c/o Tel. Eng.**

LET WILLIAMSPORT "Form-Set" STRAND render a long and faithful service

One of the important things about Williamsport Strand we wish to stress is that it will withstand any wrap, bend or acid test equal to or better than any other galvanized product obtainable.

We make a tremendous volume of Strand, having one plant devoted to its manufacture—and of course this naturally produces skill in craftsmen and promotes efficiency in the distribution of zinc on the wires, with precision in thickness—a very important operation.

When this is not accomplished, and the zinc does not adhere tightly to the steel, protection is nullified, not only because of lack of equal distribution, but because it tends to peel and flake off when sharply bent. Zinc must have a tight bond and while this may seem simple it constitutes a real science in manufacture.

Will you permit us to supply you on your next requirement? Particularly are we anxious to have you try "Form-Set" Strand for maximum service.

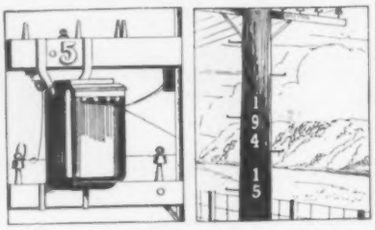
WILLIAMSPORT WIRE ROPE CO.

Williamsport, Pa. 122 South Michigan Ave., Chicago, Ill.
JOSLYN MANUFACTURING & SUPPLY CO.
20 N. Wacker Drive, Chicago, Ill.
National Distributors

Old Methods Are Out

There's a Better and More Economical Way with

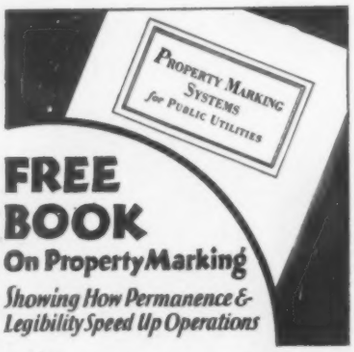
PREMAX METAL MARKERS



POWER & LIGHT CO

ABC Co

ABC



FREE BOOK

On Property Marking

Showing How Permanence & Legibility Speed Up Operations

PREMAX SALES DIVISION

CHISHOLM-RYDER CO., INC.

3819 HIGHLAND AVE.

NIAGARA FALLS NEW YORK

New Stromberg-Carlson Representative Appointed for Ohio

Walter E. Carlson

Walter E. Carlson has been named as representative for the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., to cover Southern Ohio and adjacent territory. He takes over the territory vacated by the recent death of James E. Finley, long-time representative for Stromberg-Carlson in that territory.

It was in 1914 that Mr. Carlson had his introduction to the telephone business when he started work for the Tri-State Telephone and Telegraph Company at St. Paul, Minnesota. In 1916 he left this concern to go with the Michigan State Bell Telephone Company at Detroit. While associated with this company he entered the World War. After his discharge in 1919 he was actively associated in the work of unifying the automatic and manual telephone systems of St. Paul. When this was completed he went to the installation department of the Automatic Electric Co. of Chicago, Illinois. In 1924 he started work for the Stromberg-Carlson Telephone Manufacturing Company but left soon to go with the Rolla Telephone Company at Rolla, Missouri. Between 1929 and 1933 he served as District Manager for the United Telephone Company. In 1934 he became Construction Engineer for the United States Forest Service building telephone lines in the state of Missouri, serving in this capacity until joining the Stromberg-Carlson sales organization.

The TOOL That DRILLS Concrete, Metal and Wood

WODACK "DO-ALL"
Combination
ELECTRIC
HAMMER
and
DRILL

Changed in one minute from Hammer to Drill for metal and wood—a feature that doubles the value of the "Do-All" Hammer.

Telephone companies will find this tool indispensable. Used as a hammer it drills concrete, brick and stone for expansion bolts and for carrying wires and cables through walls. Used also for chiseling channels in concrete or mortar joints, chipping, cutting openings, etc.

Mounted on the handy bench stand, or as a portable tool, the drill member serves as a grinder and buffer.

With the hammer member removed it drills metal, wood and composition, and drives grinding, buffing and wire scratch wheels. It's the complete electric tool for shop, construction and installation work.

TWO MODELS. Model "MJA" drills 5/16" in metal and 1⅛" in concrete. Model "MDH" drills ⅜" in metal, 1⅜" in concrete. Ask for Bulletin and prices.

WODACK ELECTRIC TOOL CORPORATION

4637 W. Huron St. Chicago, Ill.

Also Manufacturers of "WODACK" Electric Drills, Grinders, Buffers and Groovers.

Washington

(Continued from page 117)

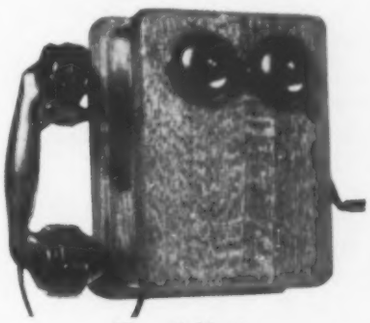
by minority sit-down strikers. A good speculation is that Lewis and the C. I. O. either will not seek to organize the telephone industry or, if that is to be an objective, it will trail far behind other industries, like auto, steel, cement, etc. But a leading aim of Lewis and the C. I. O. to interest telephone employees is believed to have a hidden goal of securing that group of employees as the nucleus of a national "white collar" union of office, technical and professional workers. Such a cross-section of workers could be a most potent labor union and also a most formidable political weapon and body.

Other legislative proposals of interest before Congress include an overhauling of the Social Security Act which should eradicate some of its present difficult provisions, revision of the present tax statute on corporate surpluses to lighten the burden on legitimate business reserves and the continuation of the present Federal tax on long distance telephone conversations. The President in his budget message to Congress recommended that it would be necessary to continue a number of the miscellaneous excise taxes including the communications levy.

Reorganize Company

Under date of October 1, the Mid-West States Utilities Co., was reorganized and its successor is the Mid-West States Telephone Co. The headquarters of the company is 141 W. Jackson Blvd., and Lon J. Jester is vice-president and general manager of the company.

MAGNETO HAND SET TELEPHONES



New Cabinets
Reconditioned Equipment
New Leich Hand Set

3 Bar	$13.50
4 Bar	14.00
5 Bar	14.25

ALBERTSON ELECTRIC COMPANY
Telephone Department
3530 W. Pierce Street
Milwaukee, Wisconsin

The **DILLON TEMPEROMETERS**

Register Correct Temperatures of —

- **Paraffin**
- **Compounds**
- **Wiping Solder**
- **Impregnation Wax**
- **Cable Damming Waxes**

THE DELUXE TEMPEROMETER (with dial) registers correct temperatures of paraffin, compounds, wiping solder, impregnation wax and cable damming waxes. Laboratory tests prove that to get the most dependable results these materials MUST be heated to specific temperatures. The DeLuxe not only tells you what these temperatures are, but is the only instrument that actually registers them for you.

THE JUNIOR TEMPEROMETER registers the correct temperature of wiping solder ONLY. Tests made with standard wiping solder composed of 40 per cent tin and 60 per cent lead show that telephone cable joints do not become porous or crystalized when wiping solder is heated to 760° F. when ladling is started over the joints. Under gas pressure tests, joints ladled with underheated and overheated solder proved to be defective.

Prices, DeLuxe Model, $6.00; Junior Model, $4.00. FOB Chicago.

SOLD BY LEADING TELEPHONE DISTRIBUTORS

DILLON MANUFACTURING CO.

63 EAST LAKE STREET — CHICAGO, ILLINOIS

COOK Terminals

Protected
Unprotected
Aerial to Underground
Test
Coil Mounting

Central Office Protection

Heat Coil and Lightning Arrester
Fuse and Lightning Arrester
Heat Coil—Fuse and Lightning Arrester

COOK

Distributing Frames

Wall
Floor
Main
Intermediate
10 to 10,000 pairs

Sub-station Arresters

Outdoor Type
Indoor Type

Lightning Arresters

Aerial Wire
Indoor

Fuses—Distributing Strips

A Complete Line of Terminal and Protective Equipment for Every Telephone Need

Cook Electric Co.
CHICAGO

Reliable

PROTECTED CABLE TERMINALS

The all metal B-27 is modern and outstanding in design with added assurance of long "terminal life."

Made in three types for three standard cable terminal fuses. Upon request we will send a sample for your inspection without charge.

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

Tom Brown Promoted

Due to the decided increase in volume of sales in 1936, The Autovent Fan & Blower Company, Chicago, announces the following promotions in its personnel and new appointments of representatives. Tom Brown has been promoted to Vice-President and General Manager, while George J. Kalwitz has been promoted from Sales Engineer to General Sales Manager.

Robert F. Ruggles, who has been Manager of the New York Office for the past few years, has been advanced to the position of Eastern Division Manager.

New representatives recently appointed are Frank B. Nimmo, Minneapolis, Minnesota; R. J. Engel, Appleton, Wisconsin; B. J. Doyle, Milwaukee, Wisconsin; Industrial Representatives, Peoria, Illinois; Allan T. Shepherd of Richmond, Virginia; Engineering Sales & Service Corporation of Louisville, Kentucky and Harold M. Hudson of Seattle, Washington. Sales of Autovent's complete line of propeller fans, blowers and unit heaters are being handled by each of the new representatives.

MASTERGRIP KABLE KING

- LOW PRICE
- QUICK INSTALLATION
- RUGGED CONSTRUCTION
- CERTIFIED MALLEABLE

ECONOMY

Installation time is cut to just a few minutes. Simply attach cable to anchor, place a plain steel pipe on driving nub and drive to desired depth. No rod is required. Priced at 76c each (slightly higher in west) or less in quantities.

CONSTRUCTION

Sturdy, rugged, cast of Certified Malleable. Engineered to hold strains up to 6,000 pounds in firm soils. Write for complete descriptive folder. For use with standard rod, Mastergrip 05 is the companion anchor.

WRITE YOUR JOBBER OR

THE AIKEN MASTERGRIP ANCHOR CO., INC.

63 East Lake Street, CHICAGO
114 North Seventh Street, SAINT LOUIS

Baker, Walsh & Company

ESTABLISHED 1921

Specialists in Telephone Financing

CHICAGO

29 South LaSalle Street Telephone Randolph 4553